MAR 20 1984

0834—N

NS1.18:31/final

ORIGINAL

494-501

667

federal funds for research and development

MF COMPLETED

60

fiscal years 1981, 1982, and 1983, volume xxxi

surveys of science resources series
national science foundation

final report

NSF 83-320

related publications

Science Resources Studies Highlights

R&D Funds

	NSF No.	Price
"Defense and Economy Major Factors in 7% Real Growth in National R&D Expenditures in 1984"	83-316	-----
"Company and Federal Support Produce 17% Industrial R&D Spending Increase in 1981"	83-313	-----
"Federal Science/Engineering (S/E) Support to Universities and Colleges Rose by 6% in FY 1981; Non-S/E Support Down 25%"	83-306	-----
"Real Growth Rate of Academic R&D Expenditures Slowed to 2% in FY 1981"	83-304	-----
"Significant Increase Expected in Industrial R&D Performance of Federal R&D Programs in FY 1983"	82-329	-----
"Growth in Federal Basic Research Support in 1980-83 Moves at Slower Rate Than in Previous Four Years"	82-325	-----
"Companies Plan R&D Expenditure Increases for 1983: Growth Rate Down"	82-324	-----
"Defense Leads R&D Growth in FY 1983—Energy and Natural Resources and Environment Fall Sharply"	82-322	-----
"Universities Spent 6% of Separately Budgeted R&D Expenditures for Research Equipment in 1980"	82-316	-----

Detailed Statistical Tables

R&D Funds

	NSF No.	Price
Academic Science/Engineering: R&D Funds, Fiscal Year 1981	83-308	-----
Federal Funds for Research and Development: Fiscal Years 1981, 1982, and 1983, Volume XXXI	82-326	-----
Research and Development in Industry, 1980. Funds, 1980; Scientists and Engineers, January 1981	82-317	-----

Reports

R&D Funds

	NSF No.	Price
Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, Fiscal Year 1981	83-315	$6.50
Federal R&D Funds for Energy: Fiscal Years 1971-83	83-301	-----
Federal R&D Funding by Budget Function: Fiscal Years 1981-83	-----	-----

Composite

	NSF No.	Price
National Patterns of Science and Technology Resources: 1982	82-319	$5.00
Academic Science: 1972-81. R&D Funds, Scientists and Engineers, Graduate Enrollment and Support	81-326	-----

Availability of Publications

Those publications marked with a price should be obtained directly from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Where no price is listed, single copies may be obtained gratis from the National Science Foundation, Washington, D.C. 20550.

(See inside back cover for Other Science Resources Publications.)

I

MICROFILMED FROM BEST
AVAILABLE COPY

federal funds for research and development

fiscal years 1981, 1982, and 1983, volume xxxi

surveys of science resources series
national science foundation

final report

NSF 83-320

II

foreword

This report on Federal agency research and development (R&D) funding is part of a series of publications specializing in the analysis of the funding activities of national economic sectors. Now in its 31st edition, this publication is based on the fiscal year (FY) 1983 Presidential budget which continues the economic revitalization policies initiated in the previous year's budget. While the report emphasizes the analyses of detailed data on R&D performers, fields of science and geographic distribution of R&D funds, it also includes more highly aggregated data to provide the necessary overall perspective. A summary of more recent data, which became available after the survey was completed, is provided for Federal R&D levels of support proposed for 1984, but in less detail than for 1983.

The 1984 budget specifically provided for increased support to basic research, especially in the defense, general science, and energy areas. This continued a pattern evident in the previous budget, with the same areas targeted for real gains.

The first section of this report brings up to date for 1983 the R&D funding strategy initiated in the 1982 budget. The second section provides a detailed analysis of leading R&D-performing sectors—Federal intramural, industrial, and academic. Historical trends are examined, with emphasis on the effects of recent changes in agency support levels on the growth, or decline, in performance of overall sectors.

Edward A. Knapp
Director
National Science Foundation

July 1983

notes

The data for FY's 1981, 1982, and 1983, as shown in the detailed statistical tables, text tables, and most of the charts, were collected from Federal agencies in March through August 1982 and were based on agency budgets as incorporated in the President's 1983 budget to Congress. Data do not reflect congressional action on that budget or changes made in classification of R&D programs of NASA.

The data are actual for 1981, but are estimated for 1982 and 1983. The 1982 data represent obligations estimated in the second quarter of FY 1982 and reflect congressional appropriation actions through that period. The data for 1983 are based on amounts proposed in the 1983 budget, when it was presented by the President in February 1982.

Table and chart details may not add to totals because of rounding.

To obtain accurate historical data, use only the latest detailed statistical tables C-112 through C-132 in *Federal Funds*, Volume XXXI (NSF 82-326) and not data published earlier. Agencies revise prior-year data when important changes occur in program classifications, and only the latest tables incorporate such changes. More complete historical data are provided in *Federal Funds for Research and Development: Detailed Historical Tables: Fiscal Years 1967-83*, available on request from the Division of Science Resources Studies, National Science Foundation.

acknowledgments

This report was prepared in the Division of Science Resources Studies under the general guidance of Charles E. Falk, Director, and William L. Stewart, Head, R&D Economic Studies Section. Eleanor H. Stoddard, Study Director, Government Studies Group, provided direction. Evelyn G. Brown, Joseph J. Geraci, and Gerard Glaser were responsible for analysis of the data and writing of the text. Dorothy K. Ham prepared statistical materials and graphic illustrations.

contents

Page

Summary Update vii

Introduction ix

Section:

1. Federal R&D Perspectives 1
   - The Role of DOD 2
   - Other Major R&D Support Agencies 2
   - Relationship to Broader Indicators 3
   - Character of Work 4
   - Fields of Science and Engineering 6

2. Performers of Federal Research and Development: An Overview 9
   - The Background 9
   - Federal Intramural 10
   - Industrial Firms 13
   - Universities and Colleges 16
   - FFRDC's 18

3. Geographic Distribution, 1981 21
   - The Leading States 21
   - Relative Rates of Growth 24
   - Distribution of Funds by Performer 25
   - Factors in R&D Performing Capability 28
   - R&D Plant 28

Appendixes:

A. Technical Notes 31

B. Federally Funded Research and Development Centers, Fiscal Years 1981-83 ... 37

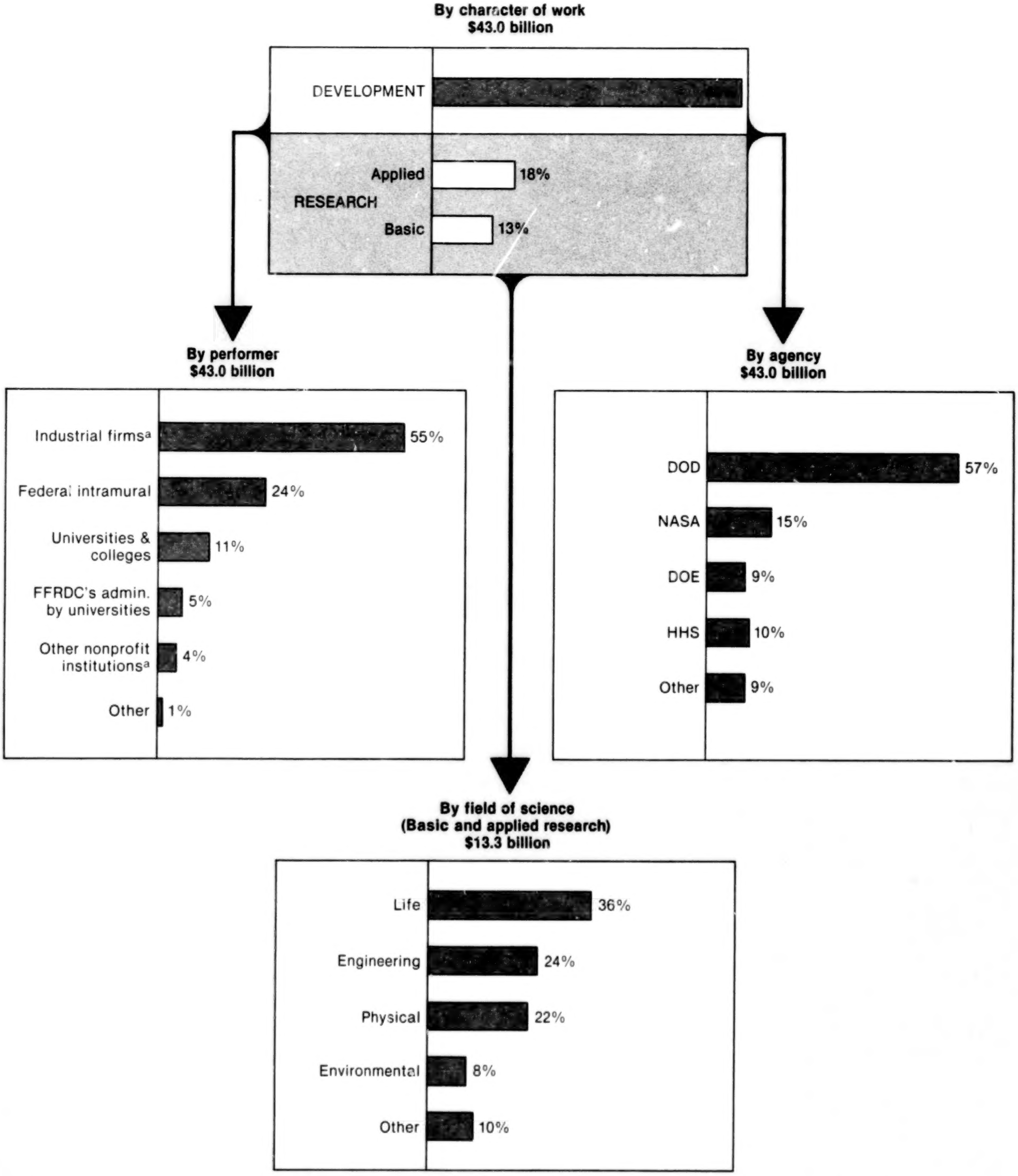
C. Listing of Statistical Tables and Summary Tables[1] 39

---

[1] See notes on p. 43.

MICROFILMED FROM BEST AVAILABLE COPY

Distribution of Federal obligations for research and development in the President's FY 1983 budget



[a] Includes federaly funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

MICROFILMED FROM BEST AVAILABLE COPY

summary update

During preparation of this report, the President's budget for FY 1984 was released. Since it contains updated R&D data for 1983 as well as proposed funding levels for 1984, major features of that budget are summarized here. Data in subsequent sections which are considerably more detailed, are based on a survey of Federal agencies planned distribution of the President's 1983 budget and do not reflect recent congressional action on that budget. It should be noted that in the 1984 budget, classification of R&D activities of NASA were revised to exclude funding for the operational aspects of the Space Shuttle program. R&D support levels as presented in the President's 1984 budget are shown below:

The 1984 budget includes $45.8 billion for research and development, 18 percent over the 1983 level. The budget continues the administration's established policies toward support of R&D activities in areas of national needs, with special emphasis on defense and support of basic research in the physical sciences and engineering. This emphasis is reflected in the strong increases in R&D obligations proposed for the Department of Defense (DOD), 29 percent, including a 13-percent increase in DOD basic research programs, as well as the growth scheduled for basic research programs in the National Science Foundation (NSF) (18 percent), the Department of Energy (DOE) (19 percent), and the National Aeronautics and Space Administration (NASA) (13 percent). The 10 percent increase shown for overall Federal basic research funding will provide for a real increase after inflation of more than 4 percent above 1983.

As a fraction of the total Federal budget, outlays for R&D and R&D plant grow significantly in the 1984 budget, ending a steady decline in this ratio evident over the entire 1974-83 period. In 1984, this ratio reaches an estimated 5.2 percent compared with 4.8 percent in 1983.

Federal obligations for research and development by major department and agency

[Dollars in millions]

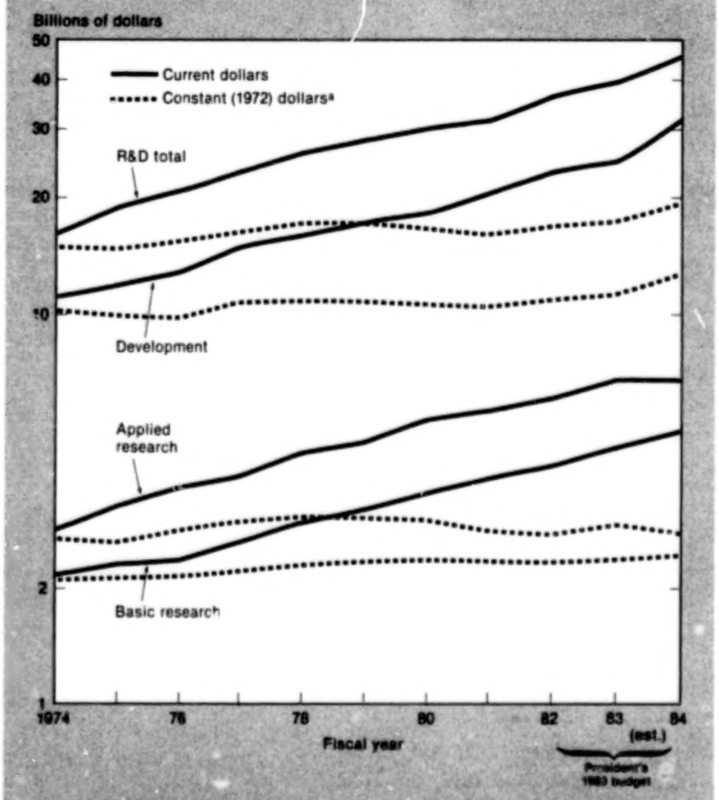
Agency	1983	1984	Percent change 1983-84
Total	$38,860	$45,796	+17.8%
Defense—Military functions	23,179	29,882	+28.9
Department of Energy	4,712	4,713	—
Department of Health and Human Services	4,316	4,416	+2.3
National Institutes of Health	3,771	3,842	+1.9
National Aeronautics and Space Administration	2,506	2,473	-1.3
National Science Foundation	1,060	1,240	+17.0
Department of Agriculture	850	849	-.1
Department of Transportation	393	519	+32.1
Department of the Interior	373	329	-11.8
Department of Commerce	312	227	-27.2
Environmental Protection Agency	241	208	-13.7
Nuclear Regulatory Commission	210	200	-4.8
Veterans Administration	165	163	-1.2
Agency for International Development	152	161	+5.9
All other[1]	391	418	+6.9

[1] Includes the Departments of Education, Justice, Labor, Housing and Urban Development and Treasury, the Tennessee Valley Authority, the Smithsonian Institution, the Corps of Engineers, and the Federal Emergency Management Agency.

SOURCE: Office of Management and Budget

Federal R&D obligations by character of work

(Semilog scale)



[a] Based on the GNP implicit price deflator for 1973-82 with estimates for inflation of 5.0 percent in fiscal year 1983 and 5.3 percent in fiscal year 1984.

NOTE: The data for R&D and development totals for the 1977-81 period are preliminary and subject to revision.

SOURCES: National Science Foundation and Office of Management

MICROFILMED FROM BEST AVAILABLE COPY

introduction

This report is one of several recurring NSF reports based on surveys that elicit data on R&D funding and scientific and engineering (S/E) personnel within the major sectors of the national economy. The data in the *Federal Funds* series cover Federal agency funding of R&D programs. In the latest report, data were based on R&D outlay and obligation levels as reported in the *Federal Funds for Research and Development, Fiscal Years 1981, 1982, and 1983,* Volume XXXI survey, conducted by NSF between March and August 1982. The 96 agency respondents, representing departments, agencies, and agency subdivisions, included all those that sponsored R&D programs during the 1981-83 budget period.

Federal agencies provided R&D data to the Office of Management and Budget (OMB) for inclusion in "Special Analysis K: Research and Development" in *The Budget of the United States Government, Fiscal Year 1983,* as part of the budget document presented to Congress in February 1982. R&D data in the OMB document and in the *Federal Funds* survey were based on the same definitions and are reconcilable, but data in the *Federal Funds* survey are classified in greater detail and cover smaller R&D support agencies not covered by OMB.

As shown in this report and in detailed statistical tables the *Federal Funds* categories cover Federal R&D data by agency, character of work (basic research, applied research, and development), performer, and field of science for the 1981-83 period and by State distribution for 1981. These categories were set forth earlier in a separate document.[2] The detailed statistical tables include historical data for the 1973-83 period.

Data in the detailed statistical tables for FY 1973 through FY 1981 are actual, but data for the next two years are estimated. Data for FY 1982 reflect obligations estimated in the second quarter of that year, including obligations carried over from prior-year appropriations, as reported by the agencies at that time. Data for FY 1983 are based on amounts requested in the President's 1983 budget. While 1983 data for some agencies include estimates for carryovers, they do not reflect subsequent appropriations or changes made by executive apportionment.

Federal Funds data are comparable from one year to the next and provide a useful measure of trends. They do not reflect the precision used for accounting purposes. Borderline problems exist in that some R&D programs are not identified as such. When they are not identified as budget line items, they must be separated by agency respondents from other, larger programs in the agency budget accounts. R&D programs must then be further subdivided into survey categories: basic research, applied research, development, performing sectors, and fields. They must also be identified in terms of distribution to States. Agency records are often kept by categories other than those requested in the survey, and in these instances, respondents must use judgment in reporting data.

The respondents have gained considerable experience, however, in meeting the survey requirements, and their efforts to report accurately and according to established definitions have continued to improve the reliability of the data. When reexamination of reporting systems and concepts has resulted in reclassification of data, agencies have revised prior-year data to maintain consistency with the latest taxonomy. For this reason, users of historical data should use only the series in the latest *Detailed Statistical Tables* or in the more extensive historical tables issued separately and available on request from the NSF Division of Science Resources Studies.

---

[2] National Science Foundation, *Federal Funds for Research and Development, Fiscal Years 1981, 1982, and 1983,* Volume XXXI (Detailed Statistical Tables) (NSF 82-326) (Washington, D.C., 1982). These are obtainable gratis from NSF.

section 1.

federal r&d perspectives

The 1983 budget included $43.0 billion in research and development (R&D) obligations (R&D plant excluded), an increase of 10 percent over the $39.0 billion estimated for fiscal year (FY) 1982. In real terms this represents a gain of 5 percent which is largely attributable to the proposed increase for R&D programs of the Department of Defense (DOD).[3]

Federal R&D support was targeted chiefly at areas of national security and programs for which there are insufficient economic incentives or resources for private sector investment. Support was phased out for technologies that showed promise of near-term commercialization. Continued Federal support was given to basic research and to high-risk technologies that require long periods of initial development and where potentially large payoffs are anticipated, as in fusion power.

In the 1983 budget only four agencies were scheduled for R&D funding at levels that reflected real growth over 1982. These were DOD, National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), and the Department of Transportation (DOT). Both NSF and DOT showed reductions in current dollars in 1982—a minimal decrease for NSF and a large decrease for DOT that cut across all major program areas.

In 1983 DOD programs were expected to reach a funding level of $24.5 billion, or 57 percent of the Federal R&D total. Proposed funding for all other agencies combined was $18.5 billion (table 1). DOD support for R&D grew 19 percent between 1982 and 1983 compared with growth of less than 1 percent for all other agencies combined.

The chief factor in the increase for nondefense R&D funds in 1983 was the 11-percent gain in NASA R&D programs. Excluding DOD and NASA, all other civilian agencies as a whole showed a 5-percent decrease. This pattern was an extension of the pattern established in the 1982 budget. That budget provided a significant growth for DOD and NASA programs, but absolute reductions in funding—or only slight growth—for the R&D programs of most other agencies (chart 1).

The 1982 budget marked a notable departure from trends in the 1973-81 period when the average annual rate of R&D growth for DOD programs was *less* than the aggregate R&D growth rate for all the other agencies. During that period scarcely any real growth was registered in funding for DOD R&D activities while an average

Table 1. Federal R&D obligations by agency: fiscal years 1973 and 1981-83

[Dollars in millions]

Agency	Actual			Estimated			
	1973	1981	Average annual percent change 1973-81	1982	Percent change 1981-82	1983	Percent change 1982-83
Total, all agencies	$16,800	$34,917	+9.6	$38,954	+11.6	$42,974	+10.3
Department of Defense	8,404	16,509	+8.8	20,602	+24.8	24,520	+19.0
Total, all agencies minus DOD	8,396	18,409	+10.3	18,352	-.3	18,454	+.6
National Aeronautics and Space Administration	3,061	5,407	+7.4	5,841	+8.0	6,513	+11.5
Department of Energy[1]	1,363	4,918	+17.4	4,583	-6.8	3,944	-13.9
Department of Health and Human Services	[2]1,672	3,927	+11.3	3,968	+1.0	4,118	+3.8
National Science Foundation	480	962	+9.1	960	-.2	1,025	+6.8
Department of Agriculture	367	774	+9.8	807	+4.3	839	+3.9
Department of Transportation	311	416	+3.7	328	-21.1	367	+11.8
Department of the Interior	247	427	+7.1	403	-5.6	365	-9.6
Department of Commerce	191	328	+7.0	281	-14.3	234	-16.7
Environmental Protection Agency	181	326	+7.6	317	-2.8	230	-27.5
Nuclear Regulatory Commission	—	220	—	216	-1.8	214	-1.0
Other agencies	524	705	+3.8	647	-8.2	606	-6.4

[1] For 1973 data for the Atomic Energy Commission were used.

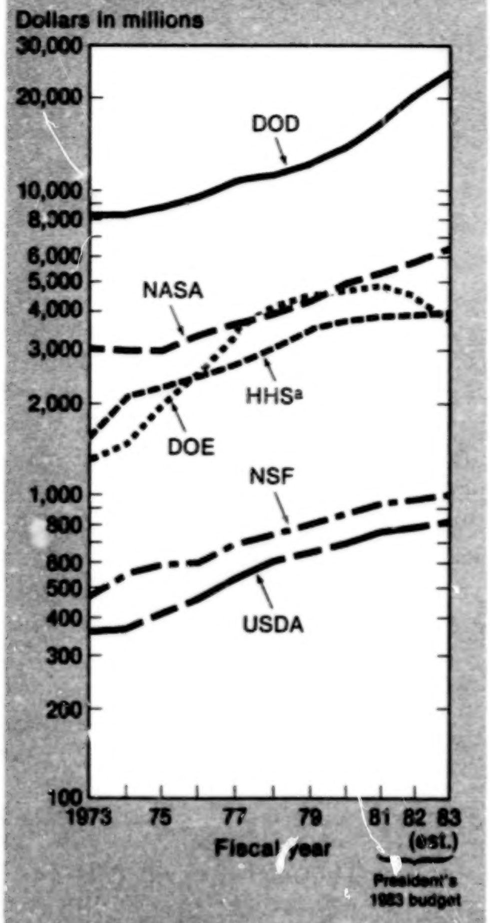
[2] Department of Health, Education, and Welfare minus the Office of Education and the National Institute of Education.

SOURCE: National Science Foundation

---

[3] An estimate for inflation of 5.0 percent based on the GNP price deflator, was used by the Office of Managemant and Budget (OMB) for fiscal year (FY) 1983.

Chart 1. Federal R&D obligations by leading support agency
(Semilog scale)



[a] Data have been adjusted to reflect only health and human services programs (without education) for fiscal years 1973-78.
SOURCE: National Science Foundation

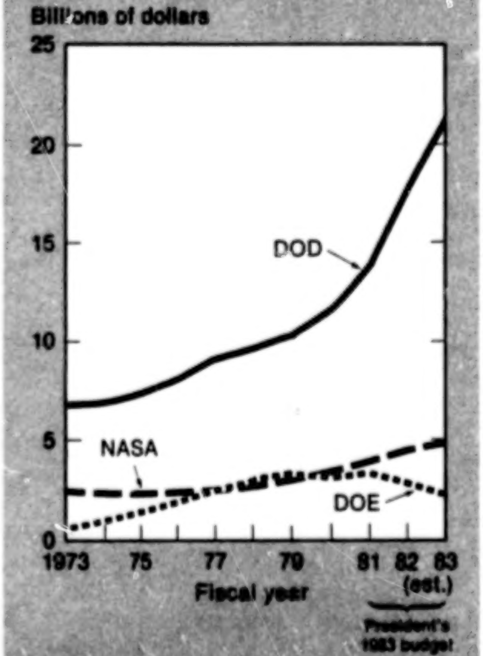
annual real growth rate of approximately 2 percent was registered for the combined R&D program totals of the other agencies. The 1982 budget strategy produced a 25-percent increase in the R&D programs of DOD between 1981 and 1982 while the combined R&D totals of all other agencies remained level.

the role of dod

Since World War II DOD has been the leading agency in Federal R&D support. In the early fifties, the DOD share of the Federal R&D total rose as high as 83 percent, but by 1964 the share had fallen to approximately 50 percent as NASA programs assumed an increasing role in the Federal R&D effort and as programs of the Atomic Energy Commission (AEC) and the Department of Health, Education, and Welfare (HEW) also grew. During the rest of the sixties and all of the seventies, the DOD share ranged between 43 percent and 52 percent.

Although the 1980 budget started to place an increased emphasis on defense programs and to reduce the emphasis on most other programs, a trend in this direction did not become sharply accentuated until the new administration presented its revised 1982 budget. In that budget and the next one, large increases were given to all the DOD mission areas within the research, development, test and evaluation (RDT&E) account: strategic, tactical, advanced technology development, intelligence and communications, and technology base. Since most programs within these areas involve large development efforts, the share of DOD in Federal development, always predominant, has been growing. The growth that began in 1980 has accelerated in the two most recent years (chart 2). The share of DOD in the Federal research total has also been growing in the same period.

Chart 2. Federal obligations for development by leading support agency



SOURCE: National Science Foundation

In the 1983 budget, large increases were directed (1) to the Air Force M-X strategic missile and an upgraded version of the B-1 bomber, (2) to development of a new Navy Trident II missile system, and, (3) to continued work on the Army ballistic missile defense systems technology program. Further development of ICBM basing and space defense programs was also included in the RDT&E strategic mission area. A range of tactical programs received increased support, and within intelligence and communications, the NAVSTAR global positioning system was a major effort. Advanced technology development programs were also scheduled for important growth. Technology base funding (entirely research) showed significant increases for all three armed services, continuing an upward trend that began in 1979.

other major r&d support agencies

NASA R&D obligations have grown at an average rate of 7.0 percent since 1973. Growth in recent years has largely represented obligations for space shuttle and space flight activities. Such high-priority items were offset only partially by reductions for planetary exploration programs and certain space applications programs that were considered more efficiently undertaken by private industry, for example, the communications satellite effort. Increases in the 1983 NASA budget included the broad NASA space transportation systems program area, which includes the shuttle, was increased 11 percent, and the space science program area was increased 18 percent, covering programs such as the space telescope, the international solar polar mission (ISPM), the gamma ray observatory, and life sciences flight experiments. The NASA space and terrestrial applications program and the aeronautical research and technology programs showed little overall change in funding in the 1983 budget.

In 1983 the Department of Health and Human Services (HHS) request an R&D increase of 4 percent, to $4.1 billion, which amounted to a decline in constant dollars. Within HHS, the National Institutes of Health (NIH) accounted for nearly nine-tenths of the R&D total. The 11 institutes

MICROFILMED FROM BEST AVAILABLE COPY

requested relative increases of 2 percent to 5 percent each, for biomedical research in various aspects of diseases. The Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA) requested an increase of 14 percent in 1983 for research in mental disorders and substance abuse, with special emphasis on alcoholism.

R&D obligations for the Department of Energy (DOE) in 1983 were scheduled for a decrease of 14 percent from the 1982 DOE level, to $3.9 billion. This reduction contrasted sharply with the average annual DOE funding growth rate of 17.4 percent between 1973 and 1981

Recent reductions for energy have included the phasing down or termination of federally sponsored R&D programs in energy technologies deemed more appropriately the responsibility of the private sector. The 1983 budget continued the curtailment begun in the previous budget of Federal R&D activities in fossil energy, solar energy, and energy conservation, and nuclear fission programs also showed a substantial decrease in 1983 despite plans to continue the Clinch River breeder reactor project. On the energy side, only DOE magnetic fusion and supporting research programs were given increases in the 1983 budget. DOE atomic energy defense R&D activities were scheduled for a 12-percent increase. Defense activities represented 43 percent of the proposed DOE R&D total in the 1983 budget, compared with 27 percent of the DOE total in 1981.

For NSF an R&D increase of 7 percent, to $1.0 billion, in the 1983 budget was slightly ahead of the growth of inflation, compared with a real decline in the previous year. This increase reflected growth in all major NSF program areas with the exception of the ocean drilling program, which was cut 30 percent. Most broad NSF programs gained between 5 percent and 7 percent except for the Antarctic program, which was proposed for a gain of 27 percent, largely directed to increased operations support costs.

The Department of Agriculture (USDA) was given an increase of 4 percent for R&D activities, the same as the previous year but less than one-half the average annual growth rate in the 1973-81 period. The R&D programs of the Agricultural Research Service (ARS), the largest USDA program area, were expected to grow 10 percent in 1983. Cooperative State Research Service programs showed virtually no growth, and Forest Service programs were cut 11 percent.

Among the agencies with smaller R&D programs, DOT received a 12-percent increase in the 1983 budget after a substantial reduction the previous year. This reflected expansion of research on air traffic control systems, computer development, and aircraft safety. A projected decrease of 10 percent for the Department of the Interior and a 28-percent decrease for the Environmental Protection Agency (EPA) largely reflected cuts in a number of natural resources and environment R&D programs. EPA pollution control and abatement research was cut 25 percent. The other major EPA research activity, on the environmental effects of various energy technologies, was cut 62 percent. Research programs of the Nuclear Regulatory Commission (NRC), related to reactor safety and regulation, were proposed for funding in 1983 at almost the same level as in 1982.

relationship to broader indicators

the federal budget

The share of R&D and R&D plant outlays within the overall Federal budget has remained relatively stable since 1975, following a steady decline during the previous 10 years. From nearly 13 percent in 1965, the share fell to approximately 6 percent in 1983 (table 2). The earlier decline resulted from the fact that non-R&D programs, chiefly social programs, were expanding more rapidly than R&D programs. This stability of the R&D ratio is derived from a resurgence of growth in Federal development programs related to energy, defense, and space that has produced sufficient growth in the Federal R&D total to keep pace with the budget as a whole.

Table 2. Federal overall budget outlays and R&D obligations and outlays: fiscal years 1960-83

[Dollars in millions]

Fiscal year	Total budget outlays[1]	Research, development, and R&D plant		R&D & R&D plant outlays as a percent of total budget outlays
		Obligations	Outlays	
1960	$ 92,223	$ 8,080	$ 7,744	8.4
1961	97,795	9,607	9,287	9.5
1962	106,813	11,069	10,387	9.7
1963	111,311	13,663	12,012	10.8
1964	118,584	15,324	14,707	12.4
1965	118,430	15,746	14,889	12.6
1966	134,652	16,179	16,018	11.9
1967	157,608	17,149	16,859	10.7
1968	178,134	16,525	17,049	9.6
1969	184,645	16,310	16,348	8.9
1970	196,588	15,863	15,734	8.0
1971	211,425	16,154	15,971	7.6
1972	232,021	17,098	16,727	7.2
1973	247,074	17,574	17,489	7.1
1974	269,620	18,176	18,297	6.8
1975	326,185	19,860	19,551	6.0
1976	366,439	21,616	21,021	5.7
1977	402,725	25,350	23,379	5.8
1978	450,836	27,683	25,679	5.7
1979	493,673	30,453	27,842	5.6
1980	579,613	33,236	31,882	5.5
1981	657,204	36,403	35,786	5.4
1982 (estimate)[2]	725,331	40,438	39,317	5.4
1983 (estimate)[2]	757,638	44,272	42,382	5.6

[1] Outlays include expenditures plus net lending.

[2] These estimates are based on amounts shown in *The Budget of the United States Government, Fiscal Year 1983*, Executive Office of the President, Office of Management and Budget.

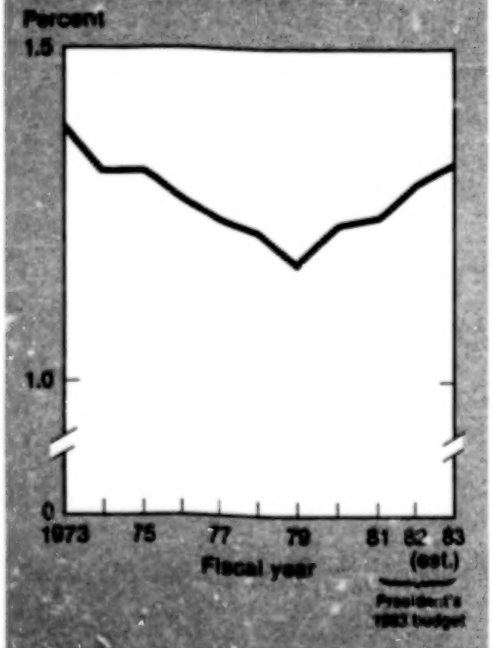
SOURCES: Office of Mangement and Budget and the National Science Foundation

the gross national product

R&D expenditures as a share of the gross national product (GNP) are sometimes used to provide a benchmark for analysis of the effects of research and development on economic growth and productivity. Although such effects can be more reliably determined only through measurement of a complex set of interactions, the R&D/GNP ratio provides some indication of trends in the proportion of the Nation's resources devoted to research and development. R&D and R&D plant outlays are used in computing these ratios.

During the 6-year period from 1973 to 1979 the Federal R&D/GNP ratio declined steadily from 1.39 percent to 1.18 percent as other areas of national expenditure grew more rapidly than Federal R&D funding (chart 3). The ratio has increased each year since 1979, however, and is estimated at 1.33 percent in 1983. The increases have been attributable to growth in DOE, DOD, and NASA spending—especially DOD—at a time when other national expenditures were showing slower rates of increase, more recently reflecting economic conditions.

Chart 3. Federal R&D and R&D plant outlays as a share of GNP



SOURCE: National Science Foundation

the national r&d total

After the midsixties, federally supported R&D activities began to play a declining role in the national R&D expenditure total. In 1964, the Federal share peaked at 66 percent and then declined almost steadily each year, reaching an estimated 46 percent in 1983.

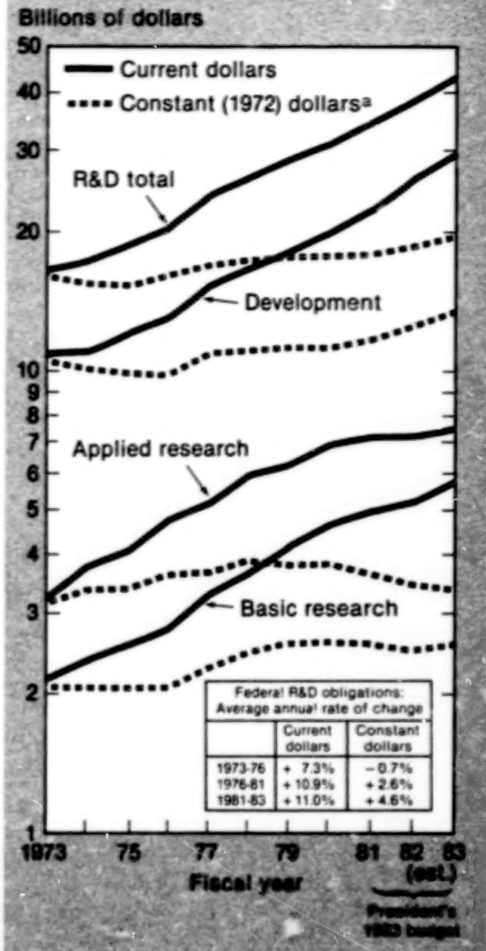
The reason for these shifts is that between 1967 and 1970 Federal R&D outlays declined in absolute terms and, thereafter, overall annual growth was slight until 1975. The gains that were registered in health, general science, and energy programs were largely offset by only slight increases in defense programs and declines in space programs. Since 1975, funding for energy, defense, and space programs has contributed substantially to overall Federal growth, but industry R&D support has been growing even more rapidly than Federal support.

The industry-supported share, which encompasses nearly all non-Federal R&D expenditures, has been rising since 1965. In recent years industrial R&D funding has reflected a response to the need for new energy conservation and development measures and to Federal regulatory policies affecting food and drugs, environmental pollution, and public safety. Furthermore, as competition has increased, particularly from foreign sources, U.S. corporate strategy has placed greater emphasis on R&D activities.

character of work

Federal current-dollar obligations for all three R&D components—basic research, applied research, and development—showed increases in each year after 1973, but the rates of growth varied (chart 4 and table 3). Although the 1983 current-dollar level of total R&D support is two and one-half times as high as the 1973 level, yielding an average annual 10-year growth rate of 9.8 percent, the constant-dollar level grew more slowly at an average annual rate of 2.0 percent.[4]

Chart 4. Trends in Federal R&D obligations
(Semilog scale)



Federal R&D obligations: Average annual rate of change

	Current dollars	Constant dollars
1973-76	+ 7.3%	− 0.7%
1976-81	+ 10.9%	+ 2.6%
1981-83	+ 11.0%	+ 4.6%

[a] Based on the GNP implicit price deflator with an estimate for inflation of 5.0 percent for 1983, as used by the Office of Management and Budget (OMB).

SOURCE: National Science Foundation

development

Most of the recent R&D growth has been provided by increases in development programs—particularly those which are defense related. Between 1976 and 1983 development support showed an estimated average annual real growth of 4.4 percent. The renewed emphasis on defense within Federal budgets produced increasingly rapid growth in DOD development funding after 1979, especially in the last two years. Between 1981 and 1982, the increase was an estimated 27 percent. In the 1983 budget, total Federal development obligations, at $29.7 billion were 13 percent higher than the 1982 level. By 1983, DOD represented 71 percent of the Federal development total.

---

[4] *Ibid.*

Table 3. Federal obligations for research and development by character of work: fiscal years 1973-83

[Dollars in millions]

Fiscal year	Research			Devel-opment
	Total	Basic	Applied	
1973	$16,800	$2,232	$3,349	$11,219
1974	17,410	2,388	3,788	11,235
1975	19,039	2,588	4,141	12,309
1976	20,780	2,767	4,852	13,160
1977	23,983	3,259	5,255	15,469
1978	26,387	3,699	5,908	16,781
1979	28,978	4,193	6,342	18,443
1980	31,680	4,674	6,923	20,083
1981[1]	34,917	5,041	7,171	22,705
1982 (est.)[1]	38,954	5,311	7,284	26,359
1983 (est.)[1]	42,974	5,765	7,500	29,709

[1] Data for 1981, 1982 and 1983 are based on the President's 1983 budget.

NOTE: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

Between 1973 and 1976, Federal development funding declined in real terms at an average annual rate of 2.4 percent. At that time DOD programs were showing little growth and NASA programs, the second largest source of development support after DOD, were actually declining. By 1975, however, the development effort of DOE (third in size of support) began to rise in response to the energy crisis; this growth did not taper off until 1979.

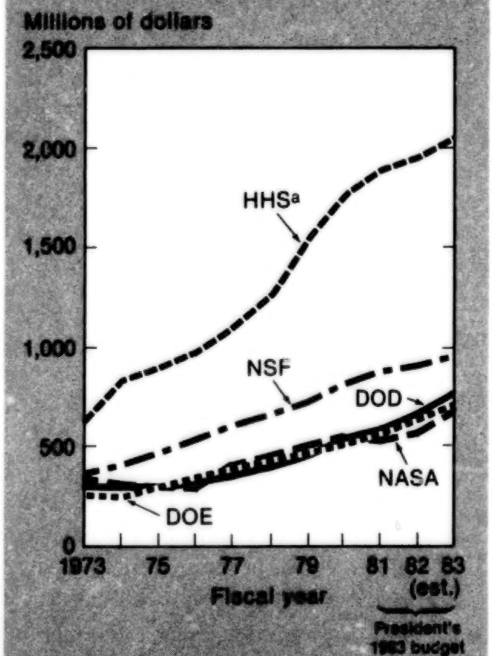
Between 1978 and 1982, an upward surge occurred in NASA support for the final phases of space shuttle development.[5] But as NASA shuttle programs become operational and as energy development programs phase down in nonnuclear areas, most development growth will be derived from DOD in the years immediately ahead.

basic research

Federal support to basic research accounts for two-thirds of all the basic research performed in the United States, with the chief effort undertaken in university laboratories. From 1973 to 1976 Federal support to basic research declined in real terms, and recognition of the probable consequences of this decline resulted in a Government policy of targeting overall basic research support at levels that would represent real growth. Thus, from 1976 through 1980, basic research support grew each year in constant dollars, with all the leading support agencies participating in the growth, especially HHS (chart 5). In 1981 and 1982, however, budget austerity measures produced support levels that represented declines in real terms.[6]

In the 1983 budget an increase of 9 percent was proposed in overall funding, to $5.8 billion in obligations (or 3 percent in constant dollars). This reflected increases for all the leading basic research support agencies with the exception of HHS (chart 6). The largest increases were given to DOD, NASA, and DOE. The budget noted the importance of basic research as an underpinning for advances in many areas, including nutrition, agricultural productivity, and new technology for defense, space, and energy.

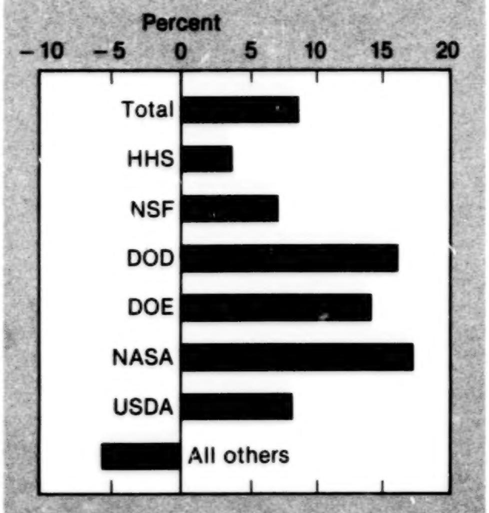
Chart 5. Federal obligations for basic research by leading support agency



aData have been adjusted to reflect only health and human services programs (without education) for fiscal years 1973-78.

SOURCE: National Science Foundation

Chart 6. FY 1982-83 percent change in Federal basic research obligations by leading support agency



SOURCE: National Science Foundation

applied research

Between 1973 and 1978 Federal obligations for applied research rose in real terms at an average annual growth rate of 4.1 percent. Even though funding continued to increase in current dollars in each ensuing year, the effects of inflation resulted in an almost steady erosion of real support. The average annual rate of decline between 1978 and 1983 was 2.8 percent. The total of proposed applied research obligations in 1983 was $7.5 billion, 3 percent over the 1982 level.

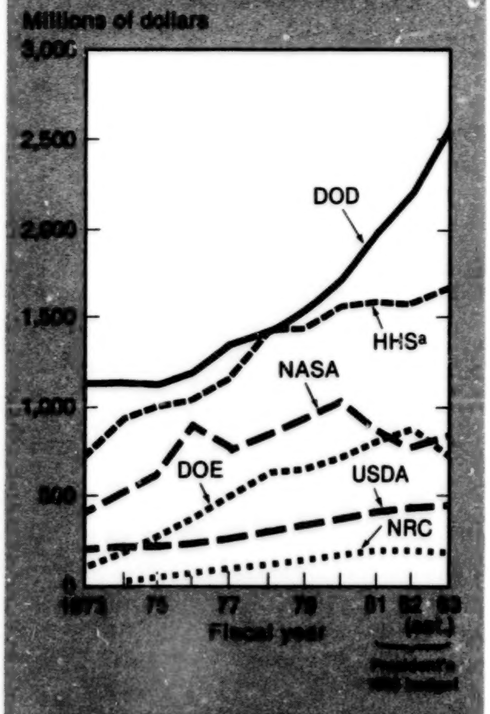
The estimated constant-dollar level in 1983 was only slightly higher than the constant-dollar level in 1975. Since that year, DOD applied research obligations have increased considerably so that DOD now makes up one-third of total Federal support, compared with approximately one-fourth in the earlier year. Growth has been slow for HHS programs, and NASA support to applied research began to drop after 1980, although an increase was expected in 1983. DOE, the other leading support agency, showed an absolute decrease in the 1983 budget, reflecting a number of energy program reductions (chart 7).

---

[5] This trend is based on R&D data reported by NASA for the 1979-83 budgets. In the 1984 budget NASA recategorized costs of space shuttle programs, separating operating from R&D costs. Tracking and data acquisition and administrative costs related to postdevelopment phases of the shuttle were also deleted. The development levels for NASA were, thereby, considerably reduced and showed a declining, instead of a rising, trend for the 1977-84 period.

[6] Data based on appropriations and other actions subsequent to the presentation of the 1983 budget now indicate a slight real growth in Federal basic research support in 1982.

Chart 7. Federal obligations for applied research, by leading support agency



aData have been adjusted to reflect only health and human services programs (without education) for fiscal years 1973-79.
SOURCE: National Science Foundation

fields of science and engineering

Federal obligations for research were expected to reach $13.3 billion in 1983, up 5 percent from the 1982 level. This relative increase was approximately one-half the average annual increase for Federal research support during the 1973-82 period.

The research total subsumes seven major fields of science plus a "not elsewhere classified" category covering multidisciplinary projects within a broad field and single-discipline projects for which a separate field is not specified in the *Federal Funds* reporting system.

The **life sciences** have been the leading field for Federal research support in the 1973-83 period, accounting for more than 35 percent of the Federal research total (table 4). The average annual rate of funding growth of 10.1 percent between 1973 and 1982 was the third highest of the seven fields. The anticipated 1982-83 increase was 3 percent, however, chiefly reflecting the limited increase given to NIH biomedical research.

Engineering, one-fourth of the Federal research total, was expected to receive an increase of 1 percent in 1983, compared with 9.6-percent average annual growth during the previous 9-year period. DOD, the largest source of Federal support to such research, reflected a 10-percent increase and NASA, next in support, a 5-percent increase. These increases, as well as a 7-percent increase in NSF support, were offset by a 40-percent decrease in DOE funding.

The **physical sciences** represent approximately one-fifth of the Federal research total. The estimated 13 percent increase in 1983 over 1982 was the third highest among the fields. From 1973 to 1982 the annual average rate of growth of 11.0 percent was second only to growth in mathematics and computer sciences research. DOE and DOD are major sources of research support to this field.

The **environmental sciences**—atmospheric, geological, and oceanographic—accounted for almost one-tenth of the Federal research total in the 1983 budget. The environmental sciences grew at an average annual rate of 7.3 percent from 1973 to 1982, but were scheduled for less than a 1-percent increase in 1983. This departure from the earlier trend resulted from decreased support on the part of the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce and the Geological Survey within the Department of the Interior, primarily to oceanographic and geological sciences.

Social sciences, now 3 percent of the Federal research total, reflected the slowest growth rate of any of the fields from 1973 to 1982—an annual average of 3.5 percent. This field was also the only one to receive less support in 1983 than in 1982, with a decrease of 2 percent. HHS has been the chief support agency, through programs in health care financing, human development, and mental health, followed by USDA and the Department of Labor, both concentrating in economics.

Table 4. Distribution of Federal obligations for research, by detailed fields of science and engineering: fiscal year 1983 (est.)

[Dollars in thousands]

Detailed fields	Total obligations	Share of total
Total, all fields	$13,264,864	100%
Life sciences, total	4,735,000	35.7
Biological (excl) environmental	2,124,376	16.0
Environmental biology	222,376	1.7
Agricultural	545,200	4.1
Medical	1,727,855	13.0
Life sciences, n.e.c.[2]	115,193	.9
Engineering, total	3,172,285	23.9
Aeronautical	684,965	5.2
Astronautical	336,500	2.5
Chemical	143,837	1.1
Civil	136,148	1.0
Electrical	624,376	4.7
Mechanical	228,946	1.7
Metallurgy and materials	314,065	2.4
Engineering, n.e.c.[2]	703,448	5.3
Physical sciences, total	2,846,294	21.5
Astronomy	386,078	2.9
Chemistry	532,818	4.0
Physics	1,762,371	13.3
Physical sciences, n.e.c.[2]	165,027	1.2
Environmental sciences, total	1,097,700	8.3
Atmospheric	390,248	2.9
Geological	369,813	2.8
Oceanography	252,752	1.9
Environmental sciences, n.e.c.[2]	84,887	.6
Social sciences, total	397,778	3.0
Anthropology	14,647	.1
Economics	148,269	1.1
Political science	8,432	.1
Sociology	52,331	.4
Social sciences, n.e.c.[2]	174,099	1.3
Mathematical and computer sciences, total	356,530	2.7
Mathematics	149,252	1.1
Computer sciences	164,545	1.2
Mathematics and computer sciences, n.e.c.[2]	42,733	.3
Psychology, total	257,986	1.9
Biological aspects	67,155	.5
Social aspects	117,721	.9
Psychological sciences, n.e.c.[2]	73,110	.6
Other sciences, n.e.c.[2]	401,291	3.0

[1] Data are based on the President's 1983 budget.

[2] Not elsewhere classified: To be used for multidisciplinary projects within a broad field and for single-discipline projects for which a separate field has not been assigned.

SOURCE: National Science Foundation

Mathematics and computer sciences represented 3 percent of the 1983 Federal research total, even though the average annual rate of growth of 13.4 percent between 1973 and 1982 was the highest of all the major fields of science. The 15-percent increase anticipated in 1983 was the second largest among the fields. Because the absolute dollar support to this field has always been small, relative to other fields, the large recent increases still do not raise the share of the total very significantly. DOD, providing approximately 60 percent of the Federal support to this field, realized increased obligations of 22 percent in the 1983 budget.

Although **psychology** commanded the smallest share of 1983 Federal research support—2 percent—this field showed the largest percent gain in the 1983 budget—20 percent. Support to psychology has increased 8.0 percent per year on the average from 1973 to 1982. HHS and DOD together provide nine-tenths of the total Federal research support to this field. Three-quarters of the 1983 proposed increase reflected DOD programs, especially those of the Army and Air Force.

section 2.

performers of federal research and development: an overview

Industrial firms make up, by far, the largest of the performers of Federal research and development and, at the present time, comprise the most rapidly growing group in terms of Federal R&D support. This section addresses growth trends of the performing sectors within the Federal R&D total. Emphasis has been placed on the most recent years.

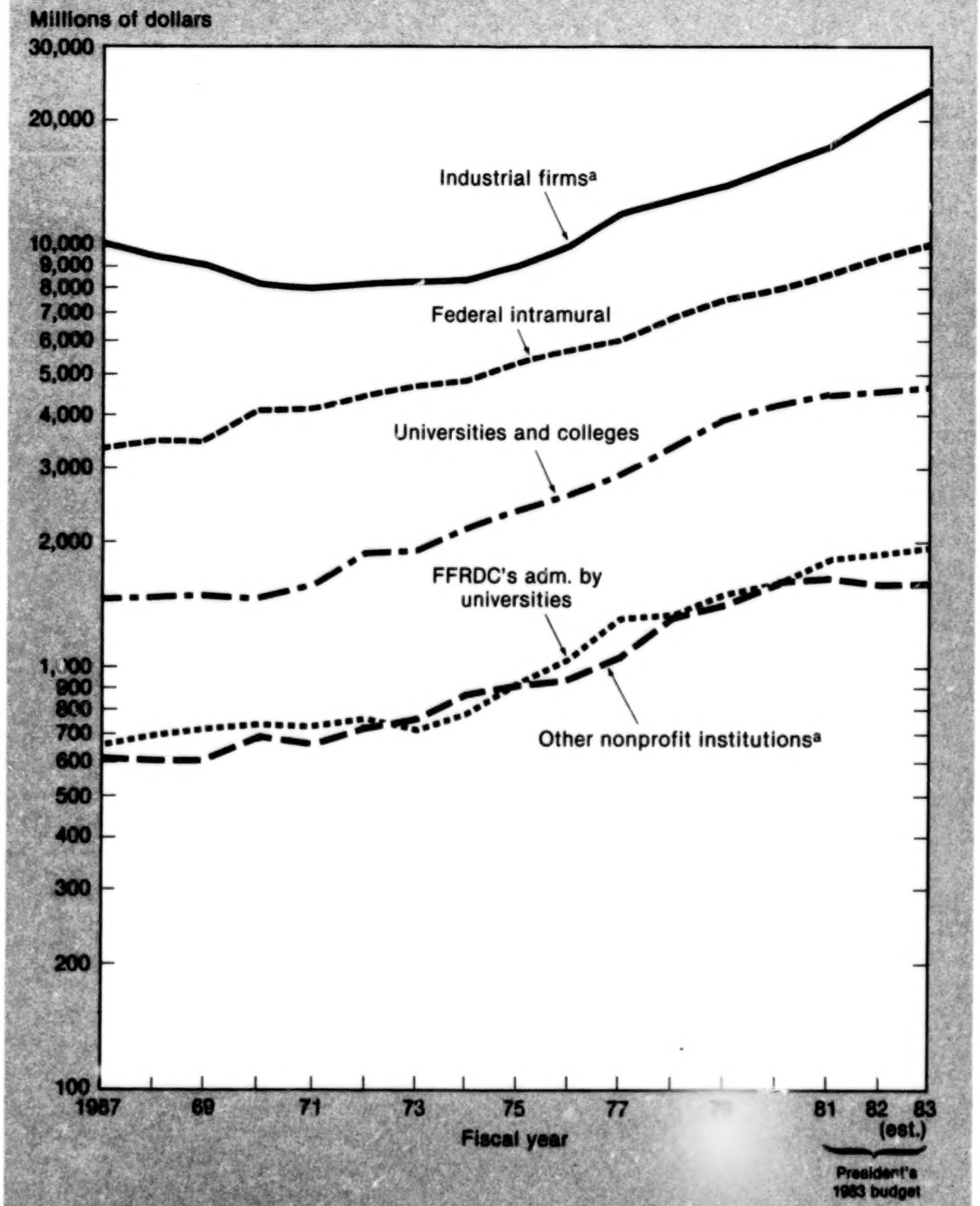
the background

Ever since World War II the largest share of total Federal R&D support has been directed to extramural performers. In the 1983 budget the share of R&D funding represented by extramural performance reached an estimated 76 percent, or $32.8 billion.

Federal intramural activities showed steady year-to-year growth throughout the 1967-83 period with less variation in rates of growth than the other performing sectors. Changes in broad performer relationships have been brought about chiefly by changes in extramural funding. The recent sharp growth in DOD programs has provided sufficient support to extramural performers, especially to industrial firms, to bring the broad extramural-versus-intramural relationship close to that of the late sixties when DOD also strongly dominated total Federal R&D activities.

Federal support to universities and colleges, largely spurred by growth in NIH and NSF programs, grew each year after 1970, but the amounts provided were not sufficient to raise the extramural share of the Federal R&D total while industry growth was moving so slowly (chart 8). Since 1981, Federal R&D funding to academia has leveled off.

Chart 8. Trends in Federal R&D obligations by major performer
(Semilog scale)



[a] Includes federally funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

federal intramural

The Federal Government is the second largest performer of federally supported R&D programs after the industrial sector, accounting currently for an estimated 24 percent of the Federal R&D total. Federal intramural performance was expected to reach $10.2 billion in 1983, a 5-percent increase over 1982, equal to the projected rate of inflation (table 5).

There are approximately 700 Federal laboratories and installations located in the 50 States, performing a diverse array of R&D activities that pertain to agency missions. This number appears not to have changed since 1967.[7] Activities embrace basic research, applied research and development. An estimated 57 percent of the support to intramural performance in 1983 was expected to be directed toward development programs, mostly those of DOD and NASA; 28 percent to plied research; and 15 percent toward basic research (chart 9).

Much of the cost of intramural work is for personnel who are either directly involved with the performance of R&D projects or, as is the case in agencies such as NSF, who are responsible for the administration of R&D activities. Between 1973 and 1983 real funding for intramural work has remained almost constant (chart 10). During this period the number of scientists and engineers employed by the Federal Government has increased by approximately 6 percent,[8] which may indicate that salaries may have fallen slightly behind the rate of inflation or that the mix of personnel has changed.

dod

DOD has always ranked first among Federal agencies in intramural R&D performance, averaging more than one-half of total Federal obligations for intramural

Table 5. Federal obligations for research and development by performer: fiscal years 1973 and 1981-83

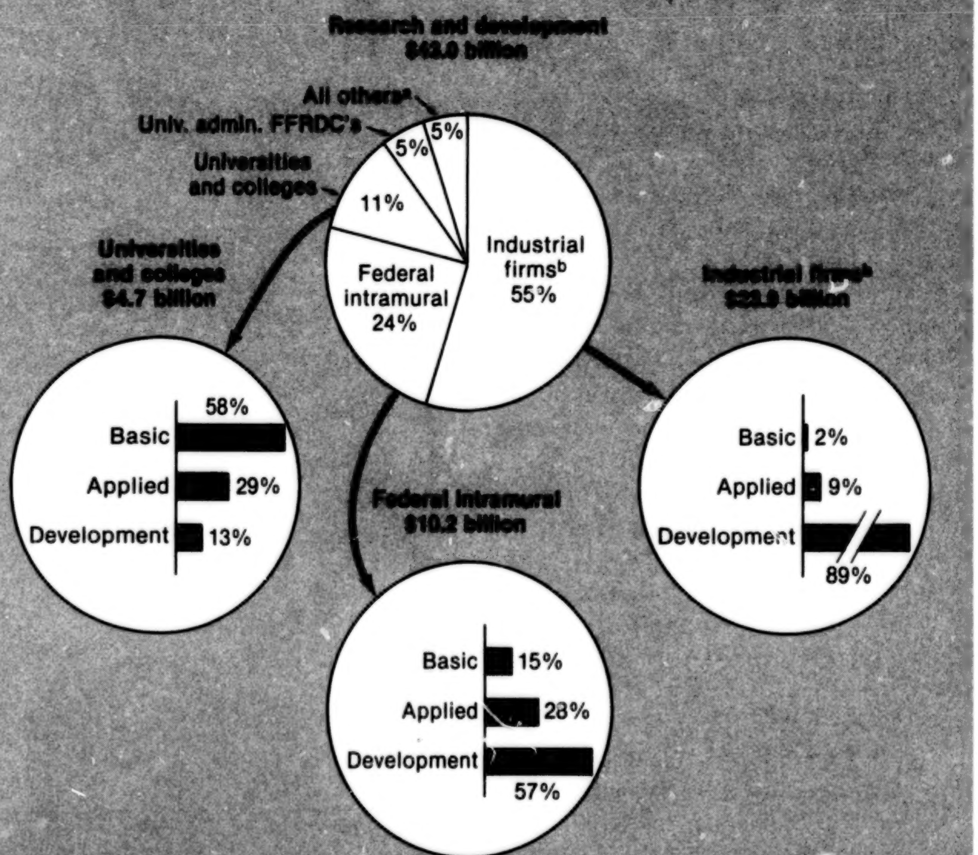
[Dollars in millions]

Agency	Actual			Estimated			
	1973	1981	Average annual percent change 1973-81	1982	Percent change 1981-82	1983	Percent change 1982-83
Total	$16,800	$34,917	+9.6	$38,954	+11.6	$42,974	+10.3
Federal intramural	4,762	8,729	+7.9	9,645	+10.5	10,164	+5.4
Industrial firms	7,731	16,261	+9.7	19,212	+18.1	22,443	+16.8
FFRDC's[1] administered by industrial firms	582	1,414	+11.7	1,477	+4.5	1,442	-2.4
Universities and colleges	1,917	4,478	+11.2	4,584	+2.4	4,720	+3.0
FFRDC's administered by universities	725	1,829	+12.3	1,890	+3.3	1,963	+3.9
Other nonprofit institutions	578	1,120	+8.6	1,112	-.7	1,166	+4.9
FFRDC's administered by other nonprofit institutions	183	525	+14.1	491	-6.5	558	+13.6
State and local governments	257	222	-1.8	202	-9.0	205	+1.5
Foreign	64	340	+23.2	342	+.6	314	-8.2

[1] Federally funded research and development centers.

SOURCE: National Science Foundation

Chart 9. Federal obligations for research and development by performer and character of work: FY 1983 (est.)



[a] Includes other nonprofit institutions, FFRDC's administered by nonprofit institutions, State and local governments, and foreign performers.

[b] Includes federally funded research and development centers (FFRDC's) administered by this sector.

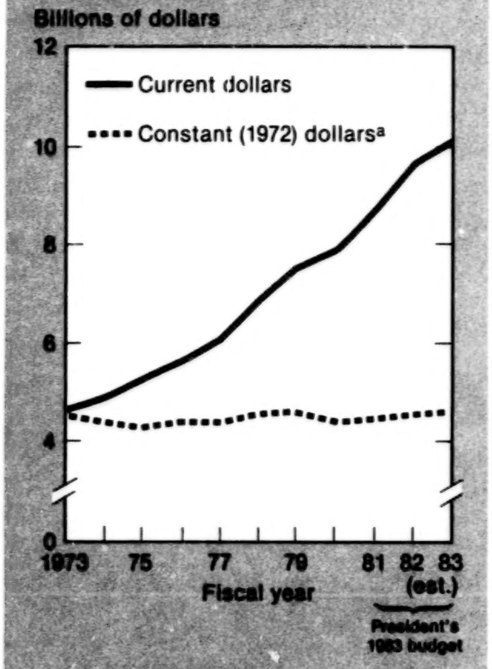
SOURCE: National Science Foundation

---

[7] See U.S. House of Representatives, 95th Congress, Second Session, *Agriculture, Rural Development and Related Agencies Appropriations for 1979* hearings, Part 2, "Investigative Report on Utilization of Federal Laboratories'," Washington, D.C. 1978. See also National Science Foundation, *Directory of Federal R&D Installations For the Year Ending June 30, 1969* (NSF 79-23).

[8] See National Science Foundation, *National Patterns of Science and Technology Resources 1982* (NSF 82-319) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1982), p. 32.

Chart 10. Trends in Federal R&D obligations to intramural performers



^aBased on the GNP implicit price deflator with an estimate for inflation of 8.0 percent in fiscal year 1983.

SOURCE: National Science Foundation

research and development during the 1973-83 period (an estimated three-fifths in 1983). DOD intramural funding showed relatively slow growth between 1973 and 1981 (table 6). In 1982 and 1983 the indicated increases for DOD were far greater than for any other agency. In those two years, intramural support for all other agencies combined actually decreased.

DOD intramural activities in the early seventies reflected fiscal constraints that were placed on overall defense budgets. During that period the DOD laboratories assumed an increasing share of technology base work (basic research plus applied research) as extramural awards were reduced because available funds were drawn upon to meet Federal comparability pay increases. A DOD policy of special support to technology base programs was initiated in 1976 to direct funding to extramural performers, including industry and universities and colleges. Intramural work also benefited, however. The interaction between intramural and extramural research teams was considered especially productive in the advancement of the state of the art of weapons technology.

From 1976 through 1983 DOD intramural funding for development showed an average annual gain of 12.6 percent, compared with an annual rate of 3.8 percent between 1973 and 1976. Added funds were directed to development of strategic and tactical systems.

Intramural applied research showed an average annual gain of 8.7 percent between 1973 and 1983, compared with an average annual decline of 1.9 percent in the earlier period. Increases encompassed work in such areas as missile technology, ballistics technology, high-energy lasers, chemical-biological defense, nuclear propulsion for ships, undersea weapons, aerospace propulsion and flight dynamics, and command, control, and communication.

Between 1976 and 1983 the average annual increase in DOD funding to intramural basic research was 9.5 percent, compared with 3.2 percent in the earlier period. Much of the effort was placed in the military sciences—in oceanography, materials sciences, medical sciences, physical sciences, and electronics, to name some leading areas.

The current emphasis on development has affected DOD intramural, as well as extramural, activities. In 1973, the development share of DOD intramural work was 73 percent, compared with an estimated 79 percent in 1983. The basic research share, however, has remained the same, at 5 percent. Applied research has declined in emphasis from a 22-percent to a 16-percent share of the DOD intramural total.

Some of the chief Air Force laboratories are the Avionics Laboratory at Wright-Patterson Air Force Base (AFB), in Ohio; the Armament Division at Eglin AFB in Florida; the Weapons Laboratory at Kirtland AFB in New Mexico; the Flight Test Center at Edwards AFB in California; and the Rome Air Development Center at Griffiss AFB in New York State.

Army laboratories include the White Sands Space Harbor in White Sands, New Mexico; the Missile Command Laboratories at Redstone Arsenal in Alabama; the Walter Reed Army Institute of Research in Washington, D.C.; the Mobility Equipment R&D Command at Fort Belvoir, Virginia; and the Chemical Systems Laboratory at the Aberdeen Proving Ground in Maryland.

Navy laboratories include the Surface Weapons Center in Silver Spring, Maryland; the Weapons Center at China Lake, California; the Research Laboratory in Washington, D.C.; the Pacific Missile Test Center at Point Mugu, California; the Underwater Systems Center, at Newport, Rhode Island; and the Air Test Center at Patuxent River, Maryland.

nasa

Since 1967 NASA has ranked second behind DOD in intramural R&D activities.

Table 6. Federal R&D obligations to intramural performers, by leading support agency: fiscal years 1973 and 1981-83

[Dollars in millions]

Agency	Actual			Estimated			
	1973	1981	Average annual percent change 1973-81	1982	Percent change 1981-82	1983	Percent change 1982-83
Total	$4,762	$8,729	+7.9	$9,645	+10.5	$10,164	+5.4
Department of Defense	2,675	4,281	+6.1	5,286	+23.5	5,978	+13.1
National Aeronautics and Space Administration	893	1,347	+5.3	1,396	+3.6	1,422	+1.9
Department of Health and Human Services, total	[1]363	872	+11.6	895	+2.6	935	+4.5
National Institutes of Health	253	639	+12.3	652	+2.0	671	+3.0
Other HHS	110	234	+9.9	243	+4.0	264	+8.5
Department of Agriculture	260	511	+8.8	521	+1.8	547	+5.1
All other agencies	570	1,718	+14.8	1,548	-9.9	1,283	-17.1

[1] HEW data were used minus data for the Office of Education and the National Institute of Education.

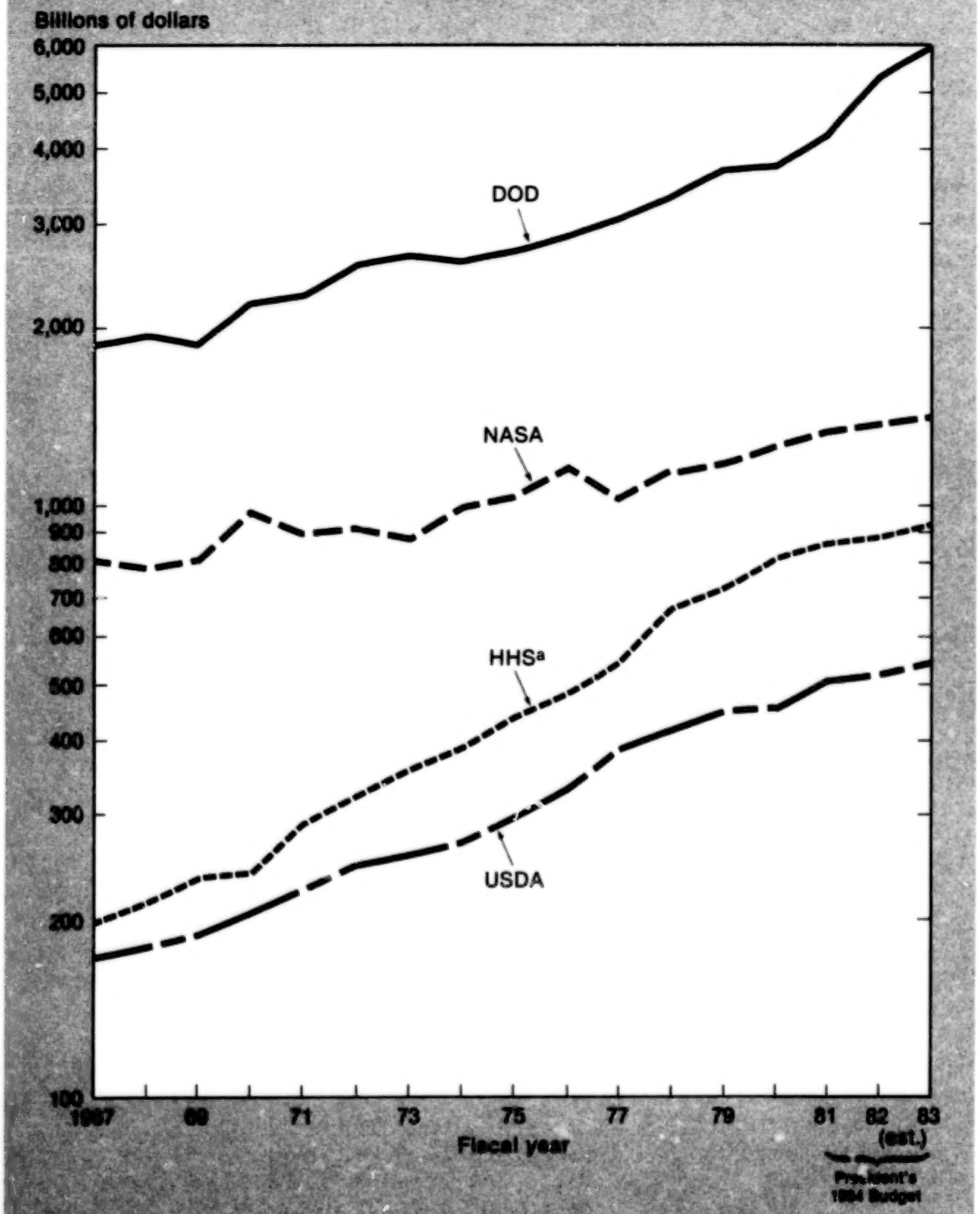
SOURCE: National Science Foundation

The average annual growth rate (4.3 percent) since 1973 has not kept pace with inflation and has been the lowest of the leading intramural support agencies (chart 11). The increase for NASA in 1983 was only 2 percent over 1982.

Some of the chief NASA facilities are the Marshall Space Flight Center in Huntsville, Alabama; the Lyndon B. Johnson Space Center in Houston, Texas; the Goddard Space Flight Center in Greenbelt, Maryland; the Langley Research Center in Hampton, Virginia; the Lewis Research Center in Cleveland, Ohio; the John F. Kennedy Space Center at Kennedy Space Center, Florida; and the Ames Research Center at Moffett Field in California.

In contrast to DOD, the intramural development effort for NASA has been declining in relative terms while the research effort has been increasing. In 1973, the development share of the NASA intramural R&D total was 58 percent compared with 43 percent in the current estimates. The basic research share has grown from 16 percent to 20 percent, and the applied research share from 26 percent to 37 percent. These figures reflect a decreasing emphasis on development efforts connected with the space shuttle program and an increasing emphasis on research connected with the space sciences program.

Chart 11. Trends in Federal R&D obligations to intramural performers by leading support agency
(Semilog scale)



aData have been adjusted to reflect only health and human services programs (without education).
SOURCE: National Science Foundation

hhs

HHS has ranked third in intramural funding since 1967 and currently accounts for 9 percent of the Federal intramural total. The leading group of activities consists of a diversity of biomedical research programs conducted at NIH facilities. NIH accounts for approximately 70 percent of the HHS intramural total. The strong growth in support to NIH programs during the seventies, especially to work in cancer and heart disease, was instrumental in producing an average annual gain in intramural funding for HHS of 11.6 percent in the 1973-81 period. Since 1981, HHS intramural growth has been slight—an increase of 3 percent in 1982 and a proposed increase of less than 5 percent in 1983. These increases reflect a somewhat lower priority for health research in recent Federal budgets as compared with other budget research areas, such as defense and space.

Intramural research activities for the HHS Alcohol, Drug Abuse and Mental Health Administration (ADAMHA) declined somewhat between 1973 and 1976. In 1977, a rising trend began as greater attention was given to mental health programs.

HHS leads all other agencies in intramural basic research support. Since 1976, NIH alone has supported more intramural basic research than any other agency. NIH basic research activities have been primarily concerned with understanding the underlying phenomena related to life processes. NIH obligations for intramural basic research increased at an average annual rate of 13.1 percent between 1973 and 1981. NIH increases in 1982 and 1983, however, were 3 percent each year—less than inflation rates.

By comparison, ADAMHA basic research support increased by 33 percent in 1982, and 16 percent in 1983—far exceeding inflation rates. ADAMHA continues to place particular emphasis on alcoholism but also conducts studies on mental disease and neurological disorders and on the biomedical factors in, and health effects of, drug abuse.

Basic research and applied research accounted for equal shares of the HHS intramural R&D total in the 1983 budget—46 percent. Development accounted for 8 percent. Rates of growth for applied research have been similar to those for basic research.

The major NIH research facilities are those of the National Cancer Institute; the National Heart, Lung, and Blood Institute; the National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases; and the National Institute of Neurological and Communicative Disorders and Stroke. The major ADAMHA laboratories and research facilities are those of the National Institute of Mental Health on the NIH campus in Bethesda, Maryland.

usda

USDA supports intramural research in disciplines related to agriculture and forestry. The R&D goals of this agency are accomplished chiefly through intramural activities (charts 12 and 13). Funding for USDA intramural work showed an average annual growth of 8.8 percent during the 1973-81 period, as compared with a 2-percent increase in 1982 and a proposed 5-percent increase in 1983.

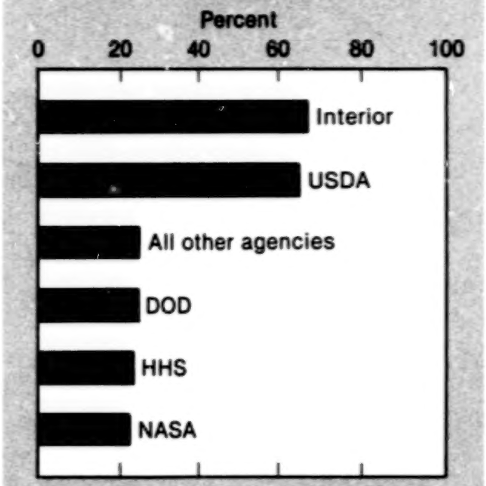
ARS is the primary contributor to USDA intramural research, making up more than 60 percent of the intramural R&D total over the 1973-83 decade. The Forest Service contributed approximately 20 percent and the Economic Research Service, approximately 10 percent.

For many years ARS research has nearly all been conducted intramurally—in animal and plant production, and in the use and improvement of soil, water, and air. This research has been almost equally divided between basic and applied, with a somewhat greater emphasis on applied research.

The Forest Service has conducted research programs on trees, timber, and watershed management; wildlife; recreation; fire control; forest insects and disease; forest products utilization; and renewable resources. Emphasis has been placed on basic, rather than applied, research.

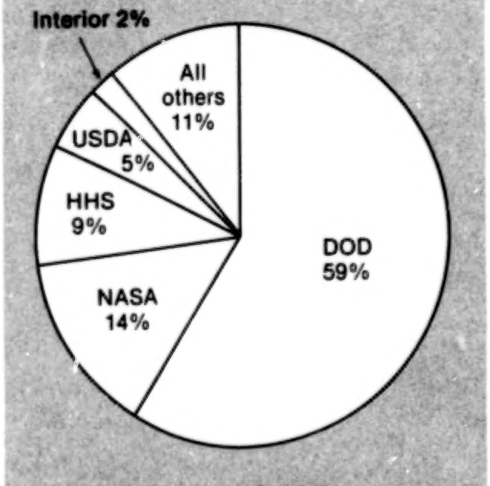
The Economic Research Service conducts research on the economics of agriculture, most of it applied in character.

Chart 12. Share of agencies' R&D total performed intramurally: FY 1983 (est.)



SOURCE: National Science Foundation

Chart 13. Share of Federal intramural R&D obligations by selected agency: FY 1983 (est.)



SOURCE: National Science Foundation

USDA sponsorship of applied research has grown almost steadily throughout the 1973-83 decade. Overall, applied research support has grown at an average annual rate of 8.2 percent for the 1973-81 timespan, with less than a 1-percent gain in 1982 and only a 3-percent gain in 1983. By contrast, average annual gains for intramural basic research show a 9.3-percent increase during the 1973-81 period, followed by a 5-percent increase in 1982 and a 10-percent increase in 1983. The greater increases for basic research are related to ARS programs.

The chief USDA laboratories of ARS, out of a total of 114, are the Agricultural Research Center in Beltsville, Maryland; the Northern Regional Research Center in Peoria, Illinois; Eastern Regional Research Center in Wyndmoor, Pennsylvania; Western Regional Research Laboratory in Albany, California; and the Southern Regional Research Center in New Orleans, Louisiana. The Forest Products Laboratory in Madison, Wisconsin is the leading one among 75 laboratories of the Forest Service.

other agencies

The remaining agencies accounted for approximately 10 percent of all Federal intramural R&D funds in 1983. The largest of these include: the Department of the Interior with $245 million; the Department of Commerce with $206 million; DOE with $148 million; the Veterans Administration with $141 million; NSF with $126 million; and EPA, $110 million.

industrial firms

Based on the 1983 budget, Federal R&D obligations of $23.9 billion directed to industrial firms (including FFRDC's)[9] were expected to account for 56 percent of all Federal R&D performance, compared with 51 percent as recently as 1981. The total represented an increase of $3.2 billion over 1982, making 1983 the third consecutive year that Federal R&D funds to industry were growing at a higher rate than to any other performing sector. The growth is chiefly attributed to development contract awards made by DOD and NASA, which more than offset the decline in DOE development activities.

Industry now accounts for the largest amount of R&D expenditures nationwide, and is increasing its efforts to stay competitive through new and improved products and processes.[10] Because of its unique role as the Nation's largest performer of research and development and the primary producer of goods and services for the Government, the industrial sector is in a better position than other sectors to assume additional R&D work for Federal agencies. In constant dollars, Federal R&D funding to industrial performers grew only slightly over the 1973-81 period, advancing at an average annual rate of 1.6 percent, in sharp contrast to an average annual rate of 9.6 percent from 1981 to 1983 (chart 14). Together, DOD, NASA, and DOE will account for an estimated 97 percent of all Federal R&D funds directed to industrial firms in 1983, with DOD by far the leading source of such funds (charts 15 and 16). The same pattern was evident in 1973.

---

[9] Throughout this analysis references to industrial firms include data for industry-administered FFRDC's.

Obligations for development were expected to account for the overwhelming share—89 percent—of Federal R&D funds provided to industrial firms in 1983. This is one reason for the size of the large industry share within the Federal R&D performance total since development is generally more expensive than basic or applied research. For each of the three leading support agencies, development contracts account for approximately nine out of 10 of the R&D dollars obligated to the industrial sector.

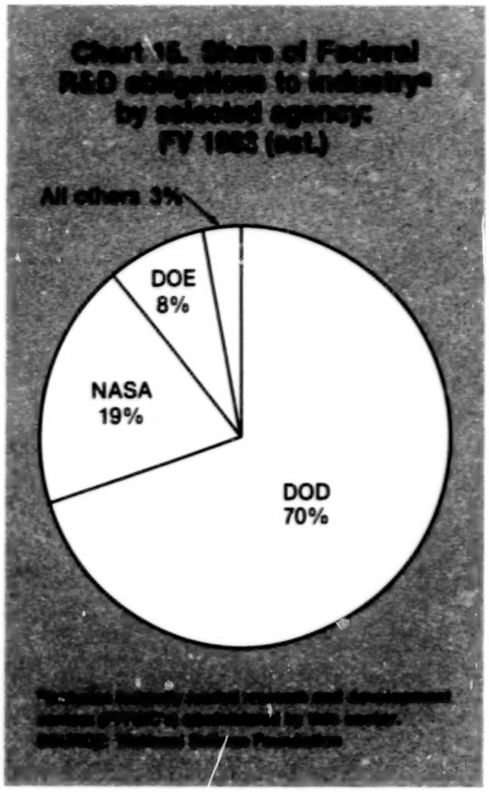


Chart 15. Share of Federal R&D obligations to industry[a] by selected agency: FY 1983 (est.)

[a]Includes federally funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

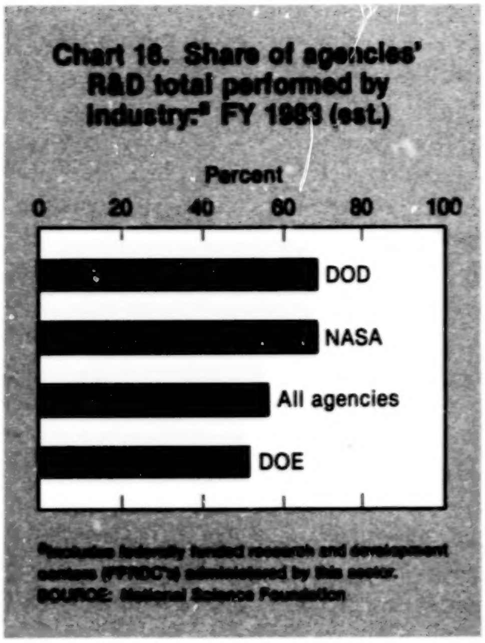
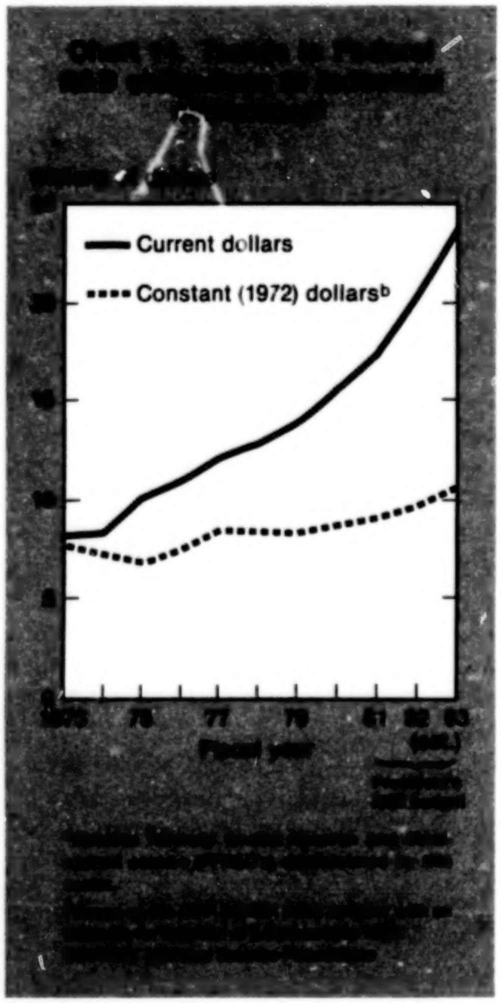


Chart 16. Share of agencies' R&D total performed by industry:[a] FY 1983 (est.)

[a]Includes federally funded research and development centers (FFRDC's) administered by this sector.
SOURCE: National Science Foundation

The share of DOD within all Federal R&D support directed to industrial performers has grown from 62 percent in 1981 to the current 70 percent—the highest since the late sixties. Opposite changes have appeared in the shares provided by DOE which, at an estimated 8 percent in 1983, has fallen well below the 19-percent high in 1979.

Between 1982 and 1983 DOD R&D obligations to industrial performers were expected to advance 22 percent, reaching a total of $16.7 billion (table 7). This increase followed a rise of 26 percent in 1982. Each of these relative increases was more than twice the average annual rate of increase of 9.9 percent in the 1973-81 period.


[illegible]

[illegible]

Table 7. Federal R&D obligations to industrial performers, by leading support agency: fiscal years 1973 and 1981-83

[Dollars in millions]

Agency	Actual			Estimated			
	1973	1981	Average annual percent change 1973-81	1982	Percent change 1981-82	1983	Percent change 1982-83
Total	$8,314	$17,675	+9.9	$20,689	+17.1	$23,884	+15.4
Department of Defense	5,140	10,931	+9.9	13,762	+25.9	16,728	+21.6
National Aeronautics and Space Administration	1,961	3,489	+7.5	3,807	+9.1	4,420	+16.1
Department of Energy[1]	773	2,486	+15.7	2,407	-3.2	2,009	-16.6
All other agencies	440	763	+7.2	713	-7.2	728	+2.2

[1] For 1973 data for the Atomic Energy Commission were used.

SOURCE: National Science Foundation

---

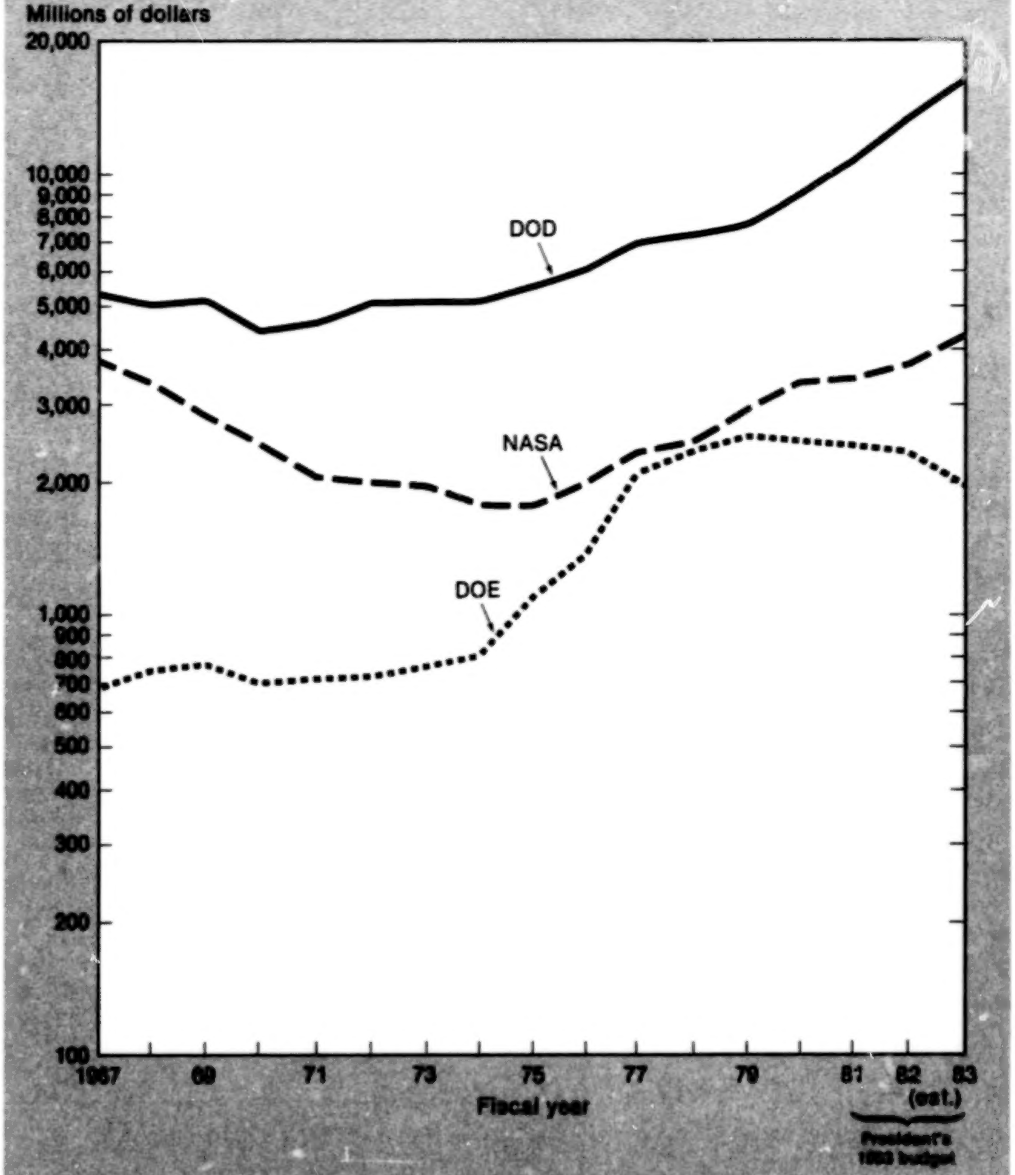
[10] National Science Foundation, *National Patterns of Science and Technology Resources*, op. cit.

MICROFILMED FROM BEST AVAILABLE COPY

NASA showed an estimated 16-percent increase in R&D obligations to industry in the 1983 budget, to a total of $4.4 billion, following a 9-percent increase in 1982. These increases compared with an average funding increase of 7.5 percent per year from 1973 to 1981 following a sharp decline from 1967 to the midseventies (chart 17).

Chart 17. Trends in Federal R&D obligations to industrial performers[a] by leading support agency

(Semilog scale)



[a]Includes federally funded research and development centers (FFRDC's) administered by this sector.

SOURCE: National Science Foundation

The pattern for DOE was the reverse of that for DOD and NASA. Based on the 1983 budget, the estimated $2.0 billion in DOE R&D obligations to industrial firms was nearly 17 percent *below* the 1982 level, and followed a decline of 3 percent in 1982. These reductions contrasted markedly with the 15.7-percent average annual increase seen for the energy agency over the 1973-81 period.

In 1983, as in 1967, the same share of DOD R&D funds was directed to industry—68 percent. In the early to midseventies, however, this share was as low as 61 percent. The comparable share for NASA was 78 percent to industry in 1967, reaching a low of 59 percent during the midseventies and then rising again. The variation in the NASA share is accounted for by cycles inherent in the course of activities related to large-scale programs, such as the Apollo moon landing of the late sixties and the space shuttle that accelerated in the next 10 years. Both of these programs required substantial efforts by industrial contractors. In 1974, the NASA budget reflected completion of the Apollo program and the transition to the major initiative for the seventies, the space shuttle. At that time, the proportion of the agency's R&D funds accounted for by intramural activities, some of which were in preparation for development of the space shuttle, reached the highest point of the 1967-83 period—33 percent.

The DOE pattern also reflects large-scale program changes. This agency has always relied on FFRDC's for the performance of nuclear R&D activities. Those administered by industry have accounted for almost one-half of total DOE obligations to industrial firms. Over the 1967-76 period the industrial share of the energy agency R&D total was typically between 55 percent and 57 percent. In 1983 industry performance was expected to account for only 51 percent of the DOE total as nonnuclear programs declined.

The remaining agencies that provide R&D support to industry have made up 3 percent to 5 percent of the industry total in the 1973-83 period. The amount of funding provided by these agencies—chiefly DOT, HHS, and EPA—has remained remarkably stable since 1981.

independent research and development

In addition to the R&D efforts industry performs in direct response to the needs of Federal agencies, certain contractors—notably those selling goods or services to DOD and NASA—also perform "independent research and development," or "IR&D." This work is "independent" in that it is conducted by the companies on their own initiative and under their own control. A portion of the cost of IR&D is recovered by the companies through overhead charged to the Government on cost-reimbursable contracts, in keeping with agreements as to the share of total company IR&D corporate activities deemed appropriate for Federal reimbursement as an allowable indirect cost.

Companies submit to sponsoring agencies portfolios of R&D projects that they have planned in areas related to their primary R&D and procurement contracts. The agencies review each project and decide whether the work is appropriate for Federal reimbursement under the IR&D program, basing decisions on the relevance of the work to the sponsoring agencies' R&D missions.

Payments to contractors for IR&D are substantial. In 1981, such payments for the first time exceeded $1 billion (table 8). Almost all such funding is provided by DOD, which has accounted for more than 90 percent of the total since 1972.

The Government has three major objectives for the IR&D support program: to create an environment which encourages development of innovative concepts for defense and space systems and equipment; to develop technical competence in contractors so that they can respond competitively to requests for proposals; and to contribute to the economic stability of contractors by allowing them technical latitude to develop a broad base of products.[11]

The dollars provided for IR&D are not separately identified in the *Federal Funds* survey, although the funds are included in DOD and NASA reported totals because IR&D reimbursements are provided through payments associated with individual R&D contracts. IR&D amounts are also covered in reports that companies make to NSF but are included as part of overall R&D expenditures.[12]

universities and colleges

Universities and colleges accounted for 11 percent of total Federal R&D obligations in the 1983 budget. The $4.7 billion directed to the academic sector was 3 percent higher than the 1982 level (table 9). The chief reason for these lower growth rates was a reduction in the rates of increase for HHS, especially for NIH. HHS accounts for approximately one-half of all Federal support to the academic sector and, therefore, has a strong influence on trends in overall support (chart 18).

Table 8. Expenditures for IR&D reimbursement by DOD and NASA to major contractors

[Dollars in millions]

Year	DOD	NASA	Total
1964	$ 270	$ 50	$ 320
1965	274	61	335
1966	315	69	384
1967	369	58	427
1968	410	61	471
1969	468	43	511
1970	436	44	480
1971	354	41	495
1972	392	40	432
1973	441	38	479
1974	467	39	506
1975	501	40	541
1976	544	41	585
1977	598	46	644
1978	643	49	692
1979	715	54	769
1980	812	57	869
1981 (est.) ...	1,023	66	1,089

SOURCES: Defense Contract Audit Agency (DCAA) and NASA unpublished data.

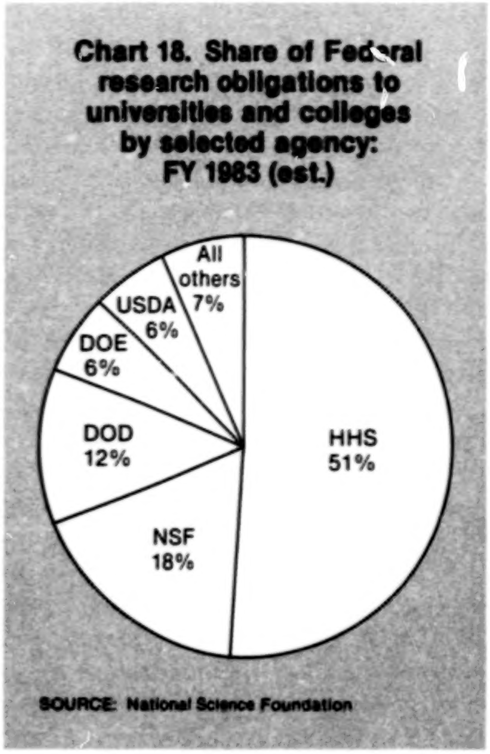


Chart 18. Share of Federal research obligations to universities and colleges by selected agency: FY 1983 (est.)

SOURCE: National Science Foundation

Table 9. Federal R&D obligations to universities and colleges, by leading support agency: fiscal years 1973 and 1981-83

[Dollars in millions]

Agency	Actual			Estimated			
	1973	1981	Average annual percent change 1973-81	1982	Percent change 1981-82	1983	Percent change 1982-83
Total	$1,917	$4,478	+11.2%	$4,583	+2.4%	$4,720	+3.0%
Department of Health and Human Services	881	2,185	+12.0	2,231	+2.1	2,285	+2.4
National Institutes of Health	761	1,984	+12.7	2,054	+3.5	2,100	+2.2
Other HHS	120	201	+6.6	177	-11.8	185	+4.4
Department of Defense	204	573	+13.8	677	+18.2	797	+17.7
National Science Foundation	374	702	+8.2	697	-.7	748	+7.3
Department of Agriculture	94	243	+12.6	266	+9.5	267	+.5
Department of Energy[1]	83	300	+17.5	269	-10.4	254	-5.6
National Aeronautics and Space Administration	111	184	+6.4	191	+4.1	191	—
All other agencies	169	291	+7.1	252	-13.6	178	-29.3

[1] For 1973 data for the Atomic Energy Commission were used.

SOURCE: National Science Foundation

MICROFILMED FROM BEST AVAILABLE COPY

---

[11] See Defense Acquisition Regulations (formerly the Armed Services Procurement Regulations), Section 15-205.35, and U.S. Department of Defense Instruction 5100.66, January 7, 1975, and December 8, 1976 for a detailed description of, and reimbursement guidelines for, IR&D efforts. For additional information regarding Federal IR&D, see David D. Acker, "Independent R&D: Key to Technological Growth," *Defense Systems Management Review,* Vol. 3 (Winter 1980), pp. 43-57; and Howard Emory Bethel, *An Overview of DOD Policy for and Administration of Independent Research and Development,* Defense Systems Management School, Defense Documentation Center, No. ADA 013362, May 1975.

[12] See National Science Foundation, *Research and Development in Industry, 1980. Funds, 1980; Scientists and Engineers, January 1981, Detailed Statistical Tables* (NSF 82-317) (Washington, D.C., 1982).

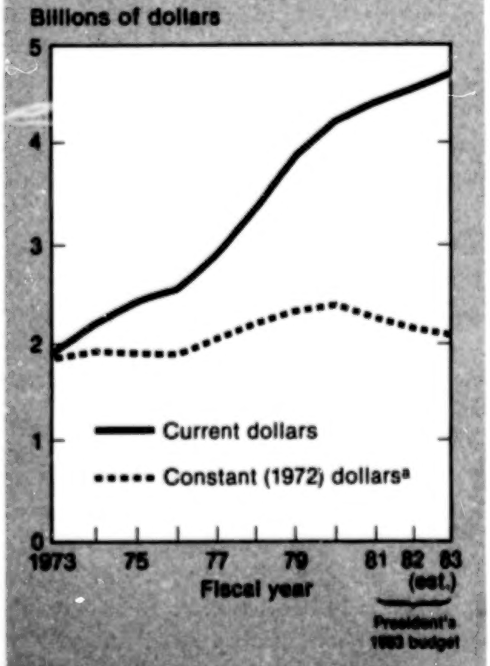
Constant-dollar gains in Federal support were registered between 1973 and 1980, followed by yearly declines through 1983 (chart 19). HHS had made the greatest contribution to the growth until 1979, but thereafter the rates of increase slowed markedly. After 1980, the increased funding provided by such agencies as NSF, NASA, and DOE dropped off; DOD was the only agency showing increases ahead of inflation.

The declining support trend for DOD continued until the midseventies, but in the meantime HHS and NSF support to universities and colleges was showing important gains. NIH received large increases in funding and much of the funds were directed to universities and their associated medical schools. NSF picked up grants from DOD and other mission-oriented agencies as a result of the Mansfield Amendment to the 1970 military procurement authorization, restricting DOD to the support of research projects that had a "direct and apparent" relationship to specific military functions and operations.[13] In the 1983 budget HHS accounted for 48 percent of the support total; DOD for 17 percent; and NSF, for 16 percent.

In the late seventies, all the leading R&D support agencies provided increased funds to academia, partly reflecting the Government policy, established in 1977 providing support to basic research at rates ahead of inflation (chart 20).

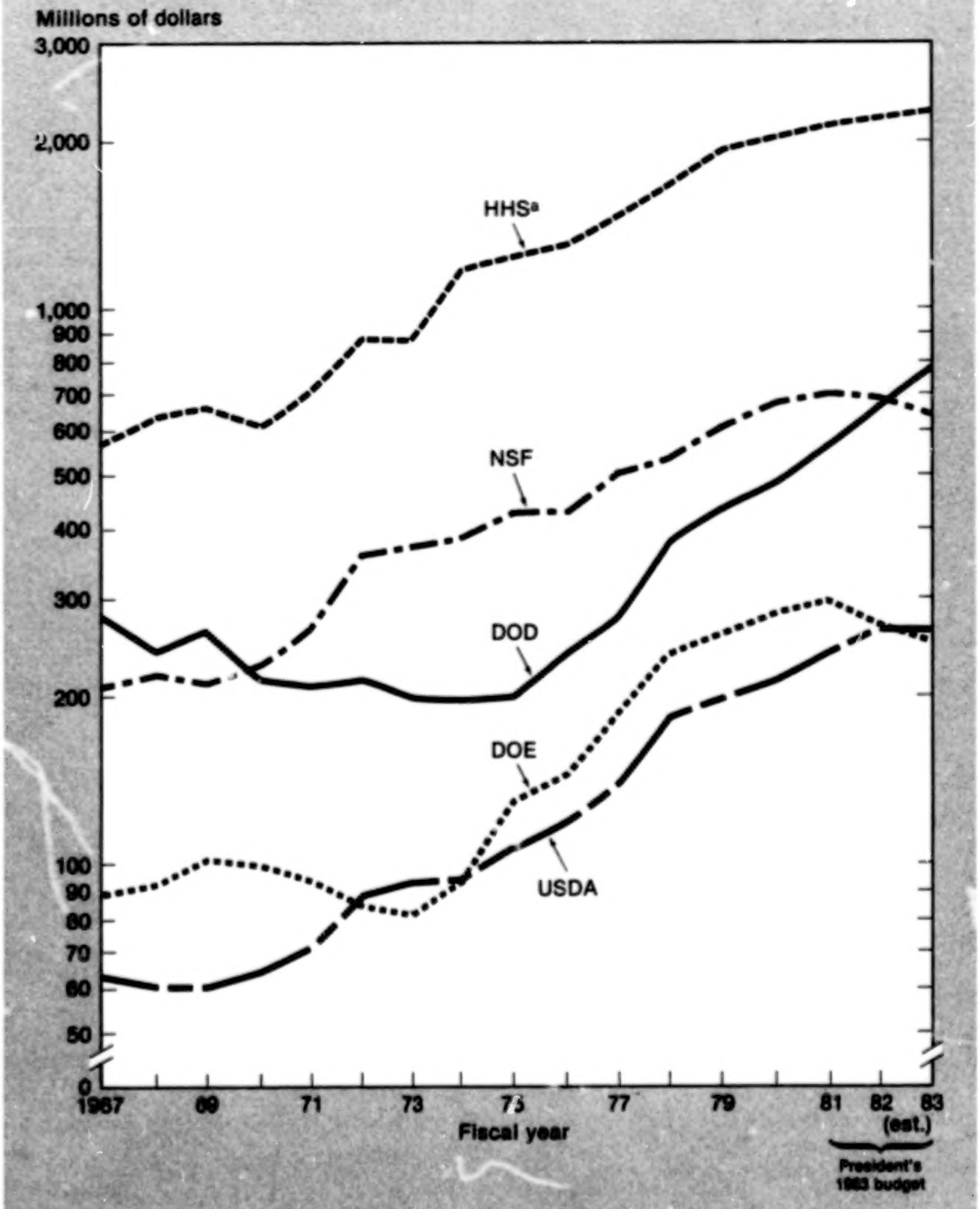
Within the total of R&D support to the academic sector, research has always far outweighed development. In 1983 an estimated 88 percent of total Federal R&D support will be in the form of research—and an estimated 58 percent in the form of basic research. For most agencies the research component makes up virtually the entire R&D commitment; only DOD

Chart 19. Trends in Federal R&D obligations to universities and colleges



[a]Based on the GNP implicit price deflator with an estimate for inflation of 5.0 percent in fiscal year 1983.
SOURCE: National Science Foundation

Chart 20. Trends in Federal R&D obligations to universities and colleges, by leading support agency
(Semilog scale)



[a]Data have been adjusted to reflect only health and human services programs (without education).
SOURCE: National Science Foundation

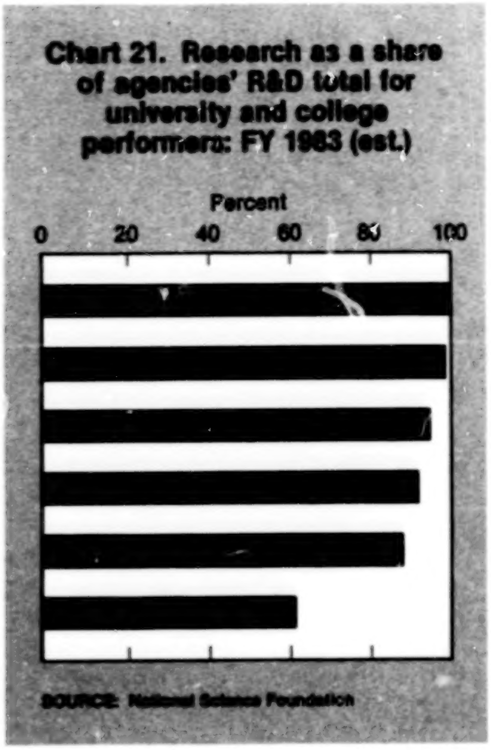
---

[13] U.S. Congress, Section 203, Title II, P.L. 91-121, Military Procurement Authorization Act of Fiscal Year 1970 (November 11, 1969).

MICROFILMED FROM BEST AVAILABLE COPY

claims a research share as low as 61 percent in 1983 (chart 21). For HHS the share is 92 percent. These two agencies provide almost all the development support directed to universities and colleges.

The trends in funding for total research support parallel those for total R&D support with the chief difference that NSF ranks second behind HHS (NIH), followed by DOD (table 10).



SOURCE: National Science Foundation

fields of science and engineering

Based on the 1983 budget, growth in Federal R&D support to academia largely depends on DOD programs, with the greatest gain in basic research to be realized from NSF support. The 1983 budget stated that special emphasis was given to strengthening basic research in the physical sciences and engineering.[14]

The budget also cited the need to maintain a strong national research effort in all scientific disciplines to provide for advances in health care, nutrition, and agricultural productivity, and new technologies for defense, space, and energy. It pointed out that researchers in universities and colleges conduct approximately one-half of all the basic research performed nationally.

Even though the NSF increase in research (and in basic research) support to academia was expected to be somewhat ahead of the rate of inflation in 1983, the anticipated growth of 7 percent was far less than the anticipated growth of 20 percent for DOD. In constant dollars all other major support agencies showed declines.

Clearly, a DOD impact could be expected in support to various fields of science. With the greatest gains among all agencies in research support in the eighties, DOD has been increasing its share of Federal support to all major fields of science (table 11). The DOD share of all research supported at universities and colleges was 9 percent in 1980 and an estimated 12 percent in 1983.

In 1983, DOD support to engineering increased to 45 percent of the research total compared with 38 percent in 1980. For environmental sciences the estimated DOD share in 1983 was 22 percent versus 18 percent in 1980, and for mathematics and computer sciences, 56 percent versus 41 percent in 1980.

Psychology also showed a significant DOD share increase, to 18 percent in 1983 compared with 14 percent in 1980.

Lesser DOD impacts on academic research were indicated in the life sciences, the physical sciences, and the social sciences.

ffrdc's

Federally funded research and development centers (FFRDC's) exist to perform or manage research and development for Federal agencies. The centers typically meet a set of particular R&D needs of Federal agencies or, in some instances, they provide major nationally utilized research facilities at universities. Each center is administered by an industrial firm, a university or university consortium, or an independent nonprofit institution. Currently, there are 34 FFRDC's. The FFRDC's differ from Federal laboratories in that FFRDC's are predominantly staffed and operated by contractor employees while government employees staff Federal laboratories.

In 1983, FFRDC's accounted for nearly $4.0 billion, or 9 percent of all Federal R&D funds (table 12). The agency providing the majority of R&D funds to FFRDC's was DOE with $2.6 billion, or about two-thirds of the total, followed by DOD with $837 million, or one-fifth. NASA and NRC accounted for $179 million and $171 million, respectively.

University-administered FFRDC's received an estimated $2.0 billion in R&D funds from the Federal Government in 1983—approximately one-half of all R&D

Table 10. Federal research obligations to universities and colleges, by leading support agency: fiscal years 1973 and 1981-83

[Dollars in millions]

Agency	Actual			Estimated			
	1973	1981	Average annual percent change 1973-81	1982	Percent change 1981-82	1983	Percent change 1982-83
Total	$1,691	$3,920	+11.1%	$3,997	+1.2%	$4,130	+3.3%
Department of Health and Human Services	792	2,000	+12.3	2,049	+2.5	2,104	+2.7
National Institutes of Health	684	1,813	+12.9	1,883	+3.9	1,927	+2.4
Other HHS	108	187	+7.1	166	-11.1	177	+6.3
National Science Foundation	370	698	+8.2	697	-.1	748	+7.3
Department of Defense	161	363	+10.7	409	+12.6	489	+19.6
Department of Agriculture	94	240	+12.4	263	+9.4	264	+.3
Department of Energy[1]	79	248	+15.4	241	-2.8	242	+.5
National Aeronautics and Space Administration	80	157	+8.7	158	+.5	158	—
All other agencies	115	214	+8.1	179	-16.1	125	-30.5

[1] For 1973 data for the Atomic Energy Commission were used.

SOURCE: National Science Foundation

---

[14] Office of Management and Budget, "Special Analysis K: Research and Development," *The Budget of the United States Government, Fiscal Year 1983* (Washington, D.C., 1982).

MICROFILMED FROM BEST AVAILABLE COPY

Table 11. Comparison of total Federal and DOD research obligations to universities and colleges by major field of science and engineering: fiscal years 1980 and 1983[1]

[Dollars in millions]

Field of science	1980			1983 estimate		
	Federal total	DOD	DOD share of Federal total	Federal total	DOD	DOD share of Federal total
Total	$3,463.6	$312.7	9.0%	$4,006.4	$488.7	12.2%
Life sciences	1,984.7	28.0	1.4	2,267.7	48.9	2.2
Physical sciences	461.0	55.1	12.0	593.0	83.4	14.1
Engineering	323.7	124.0	38.3	392.6	175.4	44.7
Environmental sciences	297.0	52.8	17.8	300.6	66.7	22.2
Mathematics and computer sciences	94.6	38.7	40.9	168.6	94.7	56.2
Social sciences	137.8	.8	.6	124.1	1.6	1.3
Psychology	89.4	12.5	13.9	99.7	17.8	17.9
Other sciences, n.e.c.[2]	75.5	.8	1.1	60.3	.3	.6

[1] Includes USDA, DOD, DOE, HHS, NASA, and NSF. Research obligations of these agencies to universities and colleges represent approximately 95 percent of the Federal total to that sector in 1980 and 1983.

[2] Not elsewhere classified.

SOURCE: National Science Foundation

Table 12. Federal R&D obligations to FFRDC's by administering sector and agency: fiscal year 1983

[Dollars in millions]

Agency	FFRDC total	FFRDC's administered by—		
		Universities	Industrial firms	Other nonprofits
Total	$3,963	$1,963	$1,442	$558
Department of Energy[1]	2,627	1,414	1,158	55
Department of Defense	837	244	118	474
National Aeronautics and Space Administration	179	179	—	1
National Science Foundation	80	78	2	(²)
Nuclear Regulatory Commission	171	28	129	14
Department of Health and Human Services	53	17	34	2
Department of Transportation	11	—	—	11
All other agencies	4	3	1	1

[1] The 1983 budget proposed that the Department of Energy be replaced by the Energy Research and Technology Administration within the Department of Commerce.

[2] Less than $500 thousand.

SOURCE: National Science Foundation

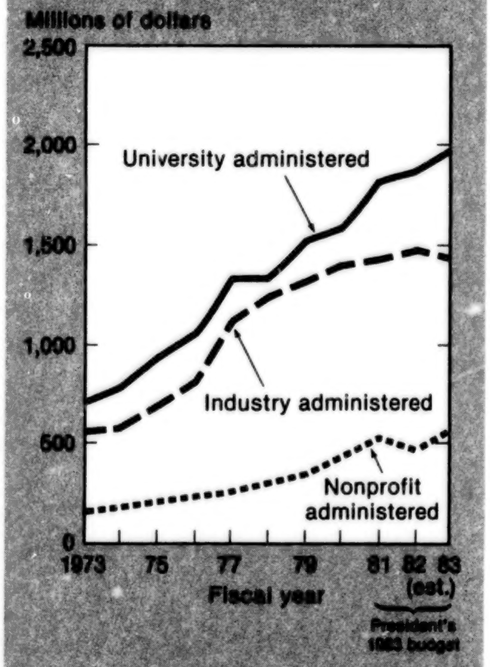
obligations to FFRDC's. This compares with approximately $1.4 billion provided to FFRDC's administered by industrial firms, and $558 million provided to those administered by nonprofit institutions.

Since most FFRDC's are sponsored by DOE, the funding growth of FFRDC's has been largely reflective of trends in funding of that agency. As chart 22 indicates, funds to industry-administered FFRDC's have leveled off since 1980 primarily as a result of reduction in energy technology programs. Funds to university-administered FFRDC's have increased primarily for work in nuclear-related weapons R&D activities.

Although all of the FFRDC's conform to the same set of definitional criteria, there are marked differences in functions. In order to highlight these differences, the centers have been grouped into four categories according to their primary activity: Research laboratories, R&D laboratories, study and analysis centers, and system engineering/system integration centers. This treatment, which is presented here for the first time, permits a clearer and more accurate appraisal of the nature of their functions. The categories are defined in the technical notes section and centers are listed by category in appendix B. The data are based on FY 1981 information, the latest date for which data for individual centers are available.

The largest group, "R&D laboratories," consists of 21 of the 34 centers with budgets in FY 1981 totaling $3.8 billion, or 85 percent of the FFRDC total. Most of the centers in this group had budgets of over $100 million in 1981. This was true of only one other group, system engineering/system integration centers. This group distinguishes itself from the others by its concentration on applied research and technology and on development and testing programs. All but two of the "R&D laboratories", DOD's Lincoln Laboratory and NASA's Jet Propulsion Laboratory (JPL), are sponsored by DOE and it is in this group that most of DOE's FFRDC's are to be found. They are, for the most part, multipurpose laboratories supporting two or more programs and consisting of large multidisciplinary facilities. They have, as a group, broad capabilities in the physical, chemical, nuclear, and life sciences, and in nuclear, electrical, and mechanical branches of engineering. There is a heavy concentration in activities related to national security, energy research and technology and, in the case of JPL, exploration of the

Chart 22. Trends in Federal R&D obligations to FFRDC's by administering sector



SOURCE: National Science Foundation

MICROFILMED FROM BEST AVAILABLE COPY

solar system. They have at their disposal a wide array of major research and testing support equipment and have developed extensive programs for making their facilities available to the scientific and technical community.

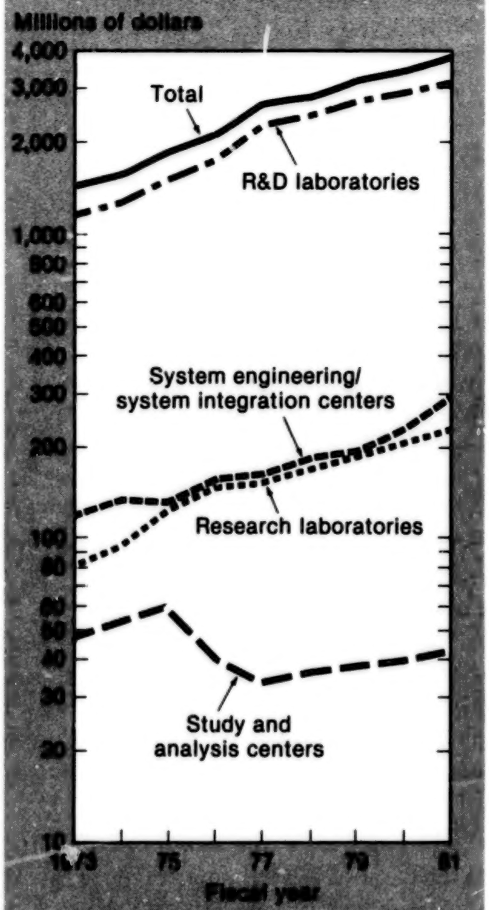
The nine centers comprising the "research laboratories" group concentrate on research activities, particularly basic research, and generally each is active in only one particular scientific area. Their diverse activities include astronomical and atmospheric research, high energy physics, and basic cancer research. The total budget for these centers in FY 1981 amounted to $283 million with individual center obligations ranging from approximately $2 million to $120 million. Six of the centers are NSF's FFRDC's (primarily astronomical facilities) which account for only 25 percent of the group's total obligations, whereas DOE's two centers, Fermi National Accelerator Laboratory (Fermilab) and Stanford Linear Accelerator Center (SLAC) account for 65 percent. Most of the centers have major, and in some instances the most advanced, facilities available for use by the scientific community. In this group are found Fermilab's powerful particle accelerator system, SLAC's 2-mile long linear accelerator, the largest collection of modern optical telescopes at Kitt Peak National Observatory, and the 1,000 foot wide radio telescope at the National Astronomy and Ionosphere Center.

The "studies and analysis" centers are involved exclusively with analytic activities and do not utilize any laboratory-related hardware other than computers. They are all defense-oriented, concerned primarily with military operations, strategies, tactical development, technologies and force structure. They carry out operations research systems analyses and other research activities involving technical and economic analysis which are used as a basis for policy decisions in planning, management, resource allocation and major system acquisition. This group had the smallest overall budget of the four groups, $44 million, and consists of three DOD centers: the Navy's Center for Naval Analysis, the Air Force's Project Air Force and the Office of the Secretary of Defense's Institute for Defense Analysis.

"System engineering/system integration" centers also include only DOD centers: the Air Force's Aerospace Corporation and the C³ Division of MITRE. The combined budgets of these centers amounted to $295 million in FY 1981, the second highest of the four groups. Their main areas of concern are with military space activities (Aerospace) and electronic communications and intelligence (C³). They provide general systems engineering and integration including overall system integration, design tradeoffs, analysis of designs, and supervision of system testing. Aerospace is particularly concerned with providing certification of readiness for launch of space craft and their launch vehicles; C³ MITRE, with the development and acquisition of command, control, communications and intelligence systems.

Between 1973 and 1979, there has been a fairly regular increase in the overall FFRDC share of the Federal R&D total, ranging from 9 percent to 11 percent. Since 1979, however, there has been evidence of a slight but continuing decline in the FFRDC share. Despite this decline, the growth rate in FFRDC obligations between 1973 and 1981 has compared favorably with the average annual percent increase in the Federal total, 12.3 percent compared to 9.6 percent, in current dollars, and 3.8 percent compared to 1.4 percent, in constant dollars. With the exception of the "study and analysis" centers, since 1973, the other three groups have shown a relatively steady increase in their level of support; in FY 1981 they were receiving, in current dollars, more than twice the level of 1973 (chart 23). The average annual percent changes for "research laboratories" and "R&D laboratories", which showed the largest increases, were 13.4 and 12.7 percent; and for "system engineering/system integration" centers, 11.6 percent. Although the "studies and analysis" centers have shown an increase in support since 1977, they are still below their 1973 level.

Chart 23. Trends in Federal R&D obligations to FFRDC's by category
(Semilog scale)



SOURCE: National Science Foundation

section 3.

geographic distribution, 1981

In 1963, 1965, and 1968, and annually since 1968, data have been collected on the geographic distribution of Federal R&D funds. The data are based on agency award records compiled after all funds for a fiscal year have been obligated. Geographic data were not yet available for 1982 and 1983 when this report was prepared. In 1981 the nine agencies participating in the geographic portion of the survey[15] reported a total of $33.7 billion in R&D obligations, almost 97 percent of the Federal R&D total in that year. These agencies also reported $1.5 billion in R&D plant obligations.

Data were reported on a prime contract basis, although additional data were obtained from NASA on the effects of first-tier subcontracting in 1981.[16] The NASA data indicate that when subcontracting is taken into account, most States show an increase in share of the R&D total as a result of funds subcontracted out of California, the largest recipient State. Some change in ranking occurs, but the same States remain in the leader group.

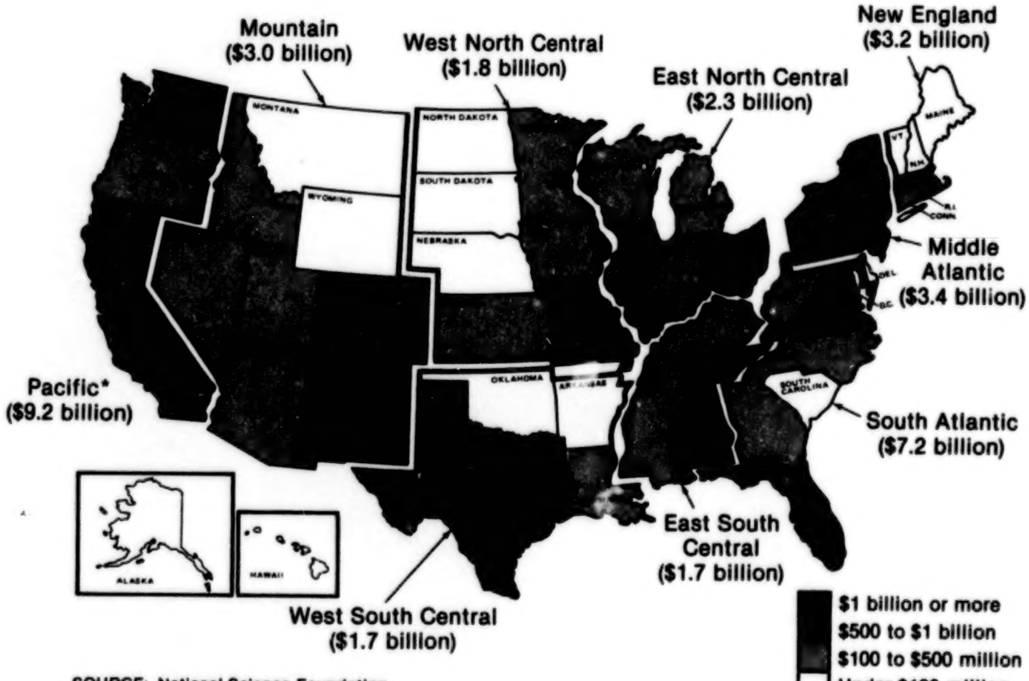
In 1981, every State and the District of Columbia received Federal R&D support.[17] California received the greatest amount—$8.0 billion; South Dakota the least amount—$10.2 million. Eleven States—California, Maryland, Massachusetts, Florida, New York, Texas, New Mexico, Virginia, Ohio, Pennsylvania, and Washington—each showed more than $1 billion in Federal R&D obligations (chart 24). In 1981 for the first time, New Mexico and Washington received Federal R&D funds of this magnitude. Since 1979, the first six of these States, plus Pennsylvania and Ohio, have remained in the $1 billion-or-more category.

the leading states

The 20 leading States received 87 percent of total Federal R&D contracts, grants and awards in 1981, and each received at least 1 percent of the Federal R&D total (table 13). These 20 States, with very few exceptions, have consistently been the leaders for the 19 years that geographic distribution data have been collected for Federal R&D obligations. They are States which offer established industrial R&D capabilities or contain Federal intramural installations or university and college complexes with a wide range of well developed research and technical specializations. The leading 15 in 1981 are shown in chart 25.

California has received the largest share of Federal R&D support each year since

Chart 24. Distribution of total Federal R&D obligations by State: FY 1981



SOURCE: National Science Foundation

---

[15] The Departments of Agriculture, Energy, Defense, Interior, Transportation, and Health and Human Services; the Environmental Protection Agency; the National Aeronautics and Space Administration; and the National Science Foundation.

[16] See National Aeronautics and Space Administration, Office of Procurement, *Annual Procurement Report, Fiscal Year 1981* (Washington, D.C., 1981).

[17] For purposes of this analysis the District of Columbia is considered a State.

MICROFILMED FROM BEST AVAILABLE COPY

Table 13. Percent distribution of Federal R&D obligations to the 20 States leading in such support in fiscal year 1981 for selected years

[Dollars in millions]

State	1971	1975	1980	1981
Total, all States	$15,240	$18,549	$30,477	$33,727
	Percent distribution			
California	21.6%	26.1%	23.4%	23.6%
Maryland	7.9	8.7	8.5	8.3
Massachusetts	5.8	6.6	6.8	7.2
Florida	5.8	4.3	4.3	4.8
New York	7.3	5.7	4.8	4.6
Texas	3.9	3.8	3.9	3.7
New Mexico	3.0	3.0	3.1	3.6
Virginia	2.8	3.9	3.4	3.4
Ohio	3.4	3.2	3.5	3.3
Pennsylvania	3.6	4.2	3.5	3.2
Washington	3.7	3.7	3.1	3.1
District of Columbia	3.1	3.1	2.6	2.8
Tennessee	1.2	1.7	2.4	2.6
Missouri	3.9	1.8	2.6	2.4
New Jersey	4.9	2.4	2.4	2.3
Colorado	1.7	1.4	1.9	1.9
Illinois	1.6	2.0	2.0	1.7
Alabama	2.4	2.0	1.8	1.7
Connecticut	1.0	1.5	1.5	1.4
Kansas	0.2	0.2	1.2	1.4
All other States[1]	11.2	10.7	13.3	13.0

[1] Includes outlying areas and offices abroad.

SOURCE: National Science Foundation

such data were first collected in 1963, when California accounted for 35 percent of the total. California's share has never been less than 21 percent (1972) and was 24 percent in 1981. This State has the largest concentration of aircraft and aerospace firms in the Nation as well as a heavy concentration of electronics firms, industries that receive large shares of DOD and NASA contracts. The $8.0 billion directed to California in 1981 was a 12-percent increase over the previous year, and higher than the 9-percent average annual increase for the 1971-80 period (table 14). The major portion of the 1981 increase was related to increased DOD contracts to industrial performers in the State.

For Maryland the share-of-total has increased since 1963, when it was less than 6 percent, to a high in 1980 of 9 percent. In 1981, Maryland's share-of-total fell to 8 percent. The $2.8 billion directed to Maryland represented a 7-percent increase over 1980, two percentage points below the previous 9-year average annual rate. Maryland has always dominated in terms of Federal intramural R&D obligations, with intramural performers accounting for just under two-thirds of all Federal R&D support within the State. The preponderant Federal intramural support is related to the numerous Federal R&D installations located in Maryland, some of the largest of which are operated by DOD, HHS, and NASA; for example, the Naval Air Test Center (DOD), Edgewood Arsenal Laboratories (DOD), National Institutes of Health (HHS), and Goddard Space Flight Center (NASA). Other Federal installations are the National Bureau of Standards (Commerce) and the Agricultural Research Center (USDA).

Massachusetts, with $2.4 billion Federal R&D obligations in 1981, has ranked third in receipt of such funds since 1973, and has commanded approximately 7 percent of the Federal R&D total since 1978. This State is heavily dependent on DOD contracts to industry, which accounted for 48 percent of the Federal R&D total for Massachusetts in 1981. In fact, DOD R&D support to all performers in Massachusetts accounted for 73 percent of the Federal R&D total. HHS, the contributor of the second largest amount of R&D funds within the State, primarily supported university and other nonprofit performers. Both DOD and NASA also provided significant shares of their R&D support to universities and colleges in the State, and both increased the level of such support over the previous year. The 18-percent increase in total Federal R&D obligations to Massachusetts, 1981 over 1980, was significantly higher than the 10-percent annual average of the previous 9 years. This 1-year increase was almost entirely attributed to increased DOD support; in particular, DOD contracts to industry. Massachusetts also has a large number of universities with extensive research capabilities; DOD and HHS both have made consistent use of the universities' complex of talents and skills.

In 1981 Florida, for the first time since 1977 ranked among the five leading States, although in 1973 it was in 4th place in receipt of Federal R&D support. With $1.6 billion, Florida received an increase of 24 percent, attributed primarily to a $121 million increase from NASA and a $177 million increase from DOD. The Florida share-of-total was 5 percent. DOD and NASA accounted for 92 percent of all Federal R&D obligations directed to this State in 1981.

Ninety-five percent of the Federal total was directed to intramural and industrial performance. Most of the intramural activities have taken place at the Kennedy Space Center in connection with NASA space transportation systems development, and at Eglin and Patrick Air Force Bases, both within the site of the Eastern Test Range. Increases over 1980 in DOD and NASA support reflect increases in ongoing programs, such as space shuttle transportation systems operations and Air Force weapons testing.

New York, with almost $1.6 billion in 1981, also received 5 percent of the Federal R&D total. The 6-percent increase over the 1980 level was twice the annual average funding rate of the previous 9 years. Approximately 47 percent of all Federal R&D obligations were directed to industrial performers and their related FFRDC's and another 29 percent to university-and-college performers. DOD, HHS, and DOE were the prime support agencies, DOD concentrating on industry, HHS on universities and colleges, and DOE on FFRDC's administered by universities.

Table 14. Federal R&D obligations by geographic division and State for selected years

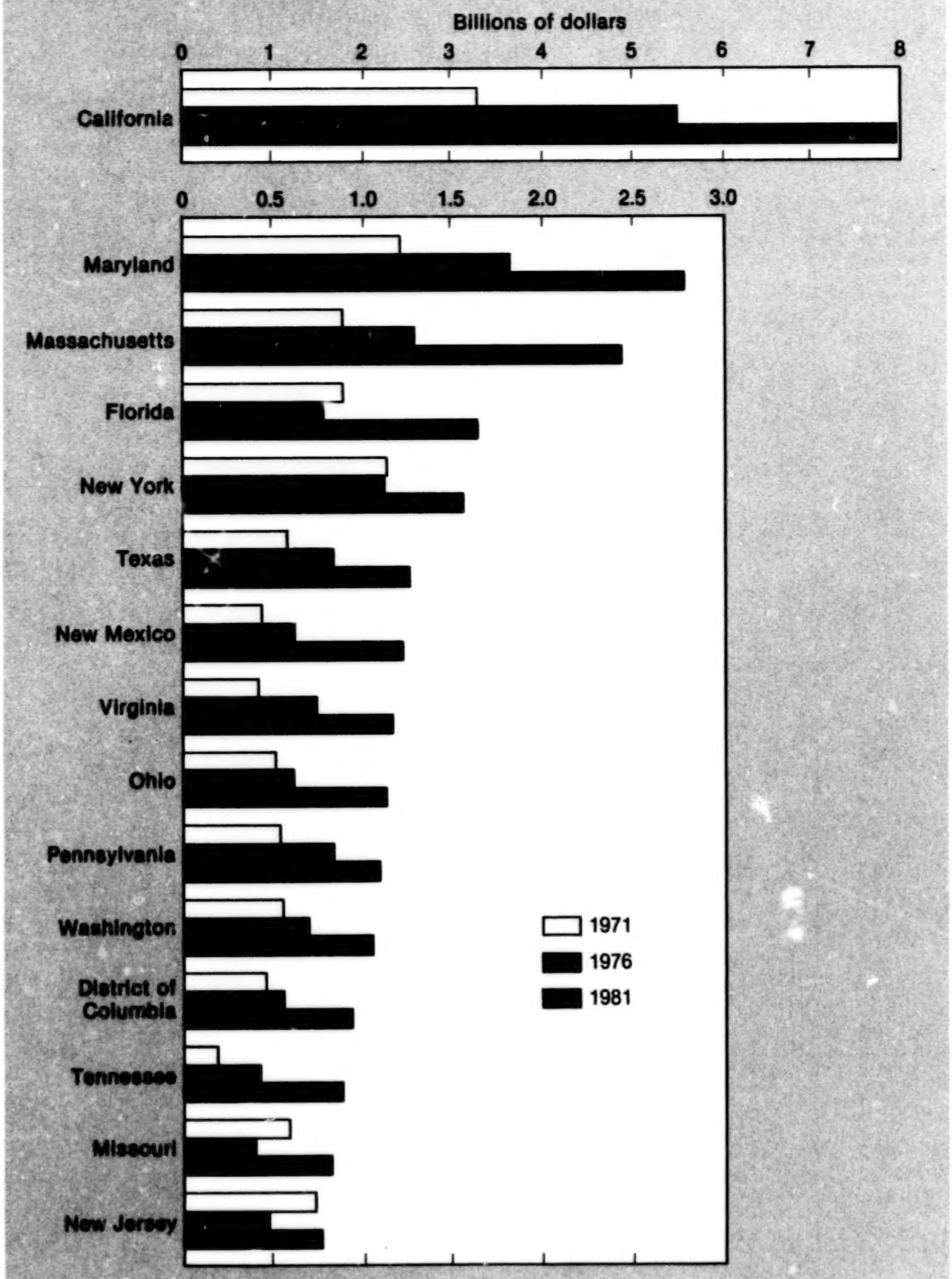
[Dollars in millions]

Division and State	1971	1980	Average annual percent change 1971-80	1981	Percent change 1980-81
Total, all States	$15,239.8	$30,477.3	8.0%	$33,726.5	10.7%
Pacific	4,004.9	8,272.8	8.4	9,220.8	11.5
Alaska	58.2	42.5	-3.5	51.8	21.9
California	3,295.4	7,138.0	9.0	7,966.0	11.6
Hawaii	38.3	42.6	1.2	49.9	17.1
Oregon	41.9	97.9	9.9	105.6	7.9
Washington	571.2	951.8	5.8	1,047.5	10.1
South Atlantic	3,224.6	6,430.2	8.0	7,238.3	12.6
Delaware	13.0	20.8	5.4	25.9	24.5
District of Columbia	478.2	807.0	6.0	932.3	15.5
Florida	890.4	1,323.5	4.5	1,634.0	23.5
Georgia	78.8	169.8	8.9	195.0	14.8
Maryland	1,201.2	2,595.0	8.9	2,783.4	7.3
North Carolina	82.7	227.7	11.9	259.8	14.2
South Carolina	23.4	87.5	15.8	96.1	9.8
Virginia	424.9	1,061.7	10.7	1,160.5	9.3
West Virginia	32.1	152.0	18.9	151.2	-.5
Middle Atlantic	2,413.5	3,260.0	3.4	3,416.0	4.8
New Jersey	745.1	729.4	-.3	775.4	6.3
New York	1,119.4	1,471.2	3.1	1,557.7	5.9
Pennsylvania	548.9	1,059.4	7.6	1,082.9	2.2
New England	1,148.8	2,814.4	10.5	3,196.0	13.6
Connecticut	149.9	470.3	13.5	485.0	3.1
Maine	13.6	25.9	7.4	24.4	-5.8
Massachusetts	887.0	2,066.7	9.9	2,430.6	17.6
New Hampshire	34.0	50.2	4.4	54.8	9.2
Rhode Island	50.5	149.9	12.8	182.5	21.7
Vermont	13.7	21.5	5.1	18.7	-13.0
Mountain	1,127.4	2,568.2	9.6	3,016.4	17.5
Arizona	88.7	334.6	15.9	367.7	9.9
Colorado	264.2	573.7	9.0	632.8	10.3
Idaho	75.3	147.7	7.8	119.5	-19.1
Montana	17.6	45.7	11.2	45.4	-.7
Nevada	159.0	214.5	3.4	263.0	22.6
New Mexico	458.7	954.2	8.5	1,224.1	28.3
Utah	55.8	243.9	17.8	305.7	25.3
Wyoming	8.1	53.9	23.4	58.2	8.0
East North Central	1,121.7	2,316.2	8.4	2,349.3	1.4
Illinois	249.1	599.9	10.3	572.6	-4.6
Indiana	74.6	162.4	9.0	170.1	4.7
Michigan	187.3	377.5	8.1	357.2	-5.4
Ohio	518.1	1,054.7	8.2	1,117.2	5.9
Wisconsin	92.6	121.7	3.1	132.2	8.6
West North Central	786.0	1,618.5	8.4	1,829.6	13.0
Iowa	32.9	121.7	15.6	147.4	21.1
Kansas	24.3	353.6	34.6	471.0	33.2
Minnesota	102.8	261.6	10.9	309.0	18.1
Missouri	596.9	801.6	3.3	820.4	2.3
Nebraska	10.4	31.6	13.1	31.7	.3
North Dakota	9.1	38.7	17.5	40.1	3.6
South Dakota	9.6	9.9	.3	10.2	3.0
West South Central	733.1	1,585.4	8.9	1,691.2	6.7
Arkansas	20.8	30.0	4.2	31.2	4.0
Louisiana	90.1	269.8	13.0	331.8	23.0
Oklahoma	26.3	94.5	15.3	82.4	-12.8
Texas	595.9	1,191.3	8.0	1,245.9	4.6
East South Central	618.2	1,492.8	10.2	1,682.7	12.7
Alabama	360.0	552.7	4.9	572.6	3.6
Kentucky	23.0	107.9	18.7	101.0	-6.4
Mississippi	46.7	109.3	9.9	125.5	14.8
Tennessee	188.5	722.9	16.1	883.6	22.2
Outlying areas	18.6	45.3	10.4	38.9	-14.1
Offices abroad	42.9	73.5	6.2	47.2	-35.8

SOURCE: National Science Foundation

MICROFILMED FROM BEST AVAILABLE COPY

Chart 25. Federal R&D support to the 15 States leading in such support in 1981 for selected years



SOURCE: National Science Foundation

While the same States remain among the 15 to 20 leaders year after year, their rank order changes. Of the leading five States in 1981, four were among the leading five during the 1971-81 decade. Florida has shifted out of this group in some years.

Aside from the five leaders, States that have been in the top 10 during the decade are Texas, New Mexico, Virginia, Ohio, Pennsylvania, and Washington. This year, Kansas joined the top 20 for the first time, replacing Michigan.

relative rates of growth

Of the 11 States receiving $1 billion or more of total Federal R&D support in 1981, Massachusetts, Virginia, and New Mexico showed the greatest average annual rates of funding growth for the 10-year period 1971-81 (table 15). If the 20 leading States are examined, then the three that showed the highest average annual rates of growth were Kansas, Tennessee, and Connecticut.

For Massachusetts, the growth rate of 10.6-percent chiefly reflects DOD support to industrial firms, as noted earlier, and, to a lesser extent, HHS support to universities. For Virginia, which averaged a 10.6-percent annual rate of growth, support was also primarily from DOD. This in-

Table 15. Relative growth in the FY 1971-81 period in Federal R&D obligations to the 20 states leading in such support in fiscal year 1971

[Dollars in millions]

State	1971	1981	Average annual percent change 1971-81
Total, all States .	$15,239.8	$33,726.5	8.3%
California . . .	3,295.4	7,966.0	9.2
Maryland . . .	1,201.2	2,783.4	8.8
Massachusetts . .	887.0	2,430.6	10.6
Florida	890.4	1,634.0	6.3
New York . . .	1,119.5	1,557.7	3.4
Texas	595.9	1,245.9	7.7
New Mexico .	458.7	1,224.1	10.3
Virginia	424.9	1,160.5	10.6
Ohio	518.1	1,117.2	8.0
Pennsylvania	548.9	1,082.9	7.0
Washington .	571.2	1,047.5	6.3
District of Columbia	478.2	932.3	6.9
Tennessee . .	188.5	883.6	16.7
Missouri	596.9	820.4	3.2
New Jersey .	745.1	775.4	.4
Colorado . . .	264.2	632.8	9.1
Illinois	249.1	572.6	8.7
Alabama . . .	360.0	572.6	4.8
Connecticut	149.9	485.0	12.5
Kansas	24.3	471.0	34.5
All other States[1] . . .	1,672.5	4,331.0	10.0

[1] Includes outlying areas and offices abroad.

SOURCE: National Science Foundation

cluded Navy contracts to industry for shipbuilding and engineering, and support for DOD intramural installations, such as the Army Laboratories at Fort Belvoir. NASA was also an important provider of Federal R&D obligations in Virginia, for example, at the Langley Research Center in Hampton and the Wallops Flight Center on Wallops Island.

New Mexico, which ranked seventh in total Federal R&D obligations in 1981, reflected a 10.3-percent average annual rate of growth from 1971 to 1981. Most of the Federal R&D support in New Mexico was received from DOE for the Sandia National Laboratories in Albuquerque and the Los Alamos National Laboratory in Los Alamos, both FFRDC's.

Kansas, with an average annual growth rate of 34.5 percent for the decade, received increasing DOD contracts to industry, a trend started in 1978. Tennessee, with an average annual 10-year growth rate of 16.7 percent, derived approximately two-thirds of all Federal support from DOE, with approximately four-fifths of that support in the form of awards to industrial firms and an FFRDC administered by industry, the Oak Ridge National Laboratory. DOD also provided substantial R&D support to Tennessee.

The States among the leading 20 with the highest relative growth in 1981 over 1980 were Kansas (up 33 percent), New Mexico (up 28 percent), Florida (up 24 percent), Tennessee (up 22 percent), and Massachusetts (up 18 percent).

While all of the 10 leading States, except New York, showed absolute increases in 1981 of more than $500 million over 1971, seven of the 10 "second-tier" States had absolute increases of more than $300 million for the same period. New Jersey, with the smallest average annual growth rate in the 10-year period, reflected declines in support from 1973 to 1976, and even with some gains thereafter, showed a level of support in 1981 close to the 1971 level.

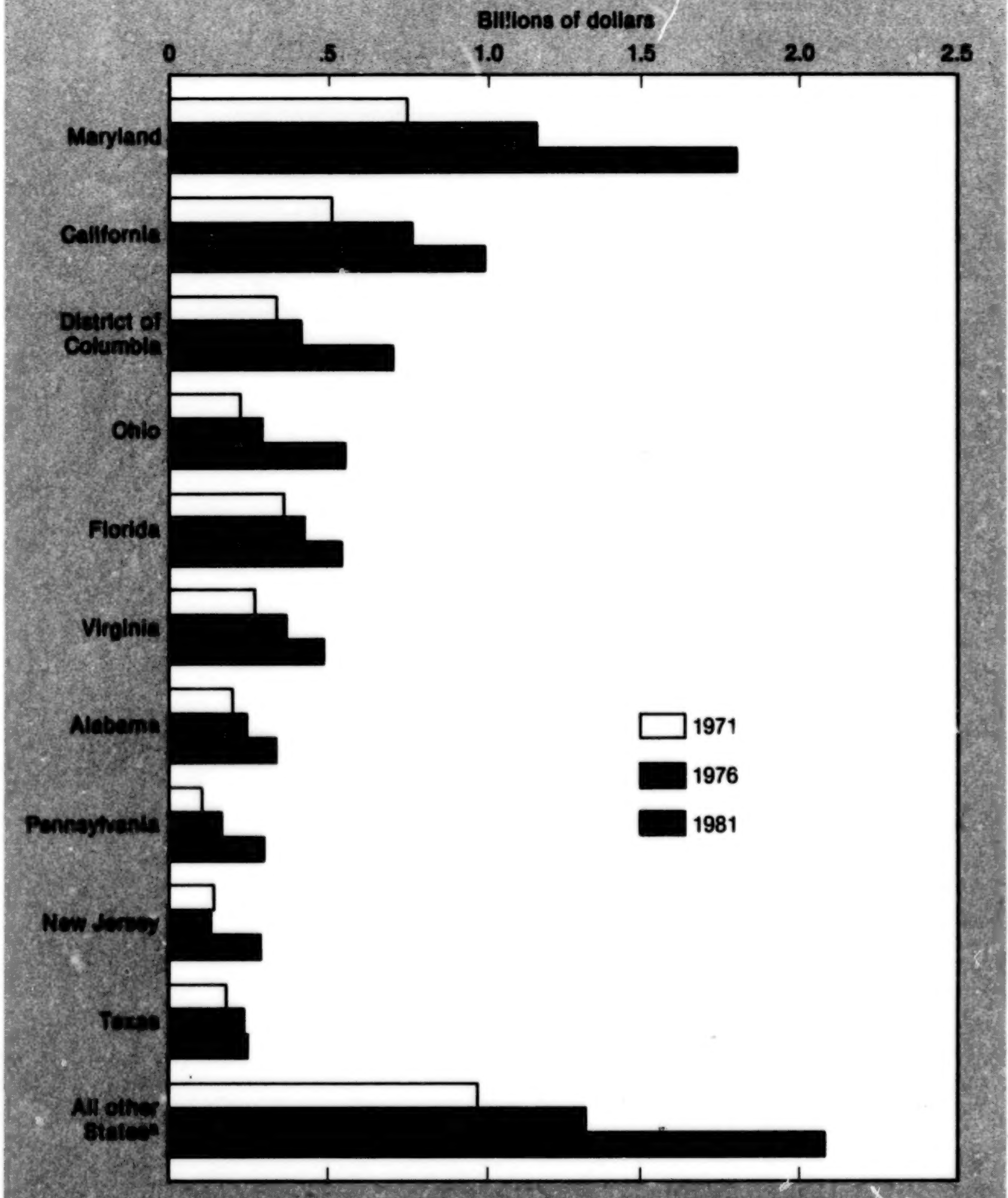
distribution of funds by performer

Four Federal agencies—DOD, NASA, DOE, and HHS—have been responsible for approximately nine-tenths of total Federal R&D obligations for many years. Therefore, the patterns of support of these agencies to performers in the various States largely determine the patterns of distribution of all Federal R&D obligations. The States with R&D performance capabilities to satisfy the needs of these four Federal agencies also tend to lead the other States in receipt of total Federal R&D support. These States tend to encompass within their borders aircraft, aerospace, and electronics firms; concentrations of university research talent, including modern medical research teams; or geographic areas safe and suitable for testing missiles, aircraft, spacecraft, and explosives.

The leading 10 States for all Federal R&D performance accounted for 66 percent of all the support to Federal intramural efforts; 67 percent of all Federal support to industry; 57 percent of total support to universities and colleges; and 69 percent of the total to nonprofit organizations.

When States are compared by performing sectors, those that have remained among the five leaders in receipt of Federal R&D funds year after year contain a strong balance of performer capabilities (charts 26, 27, and 28). Thus, in 1981, as in prior

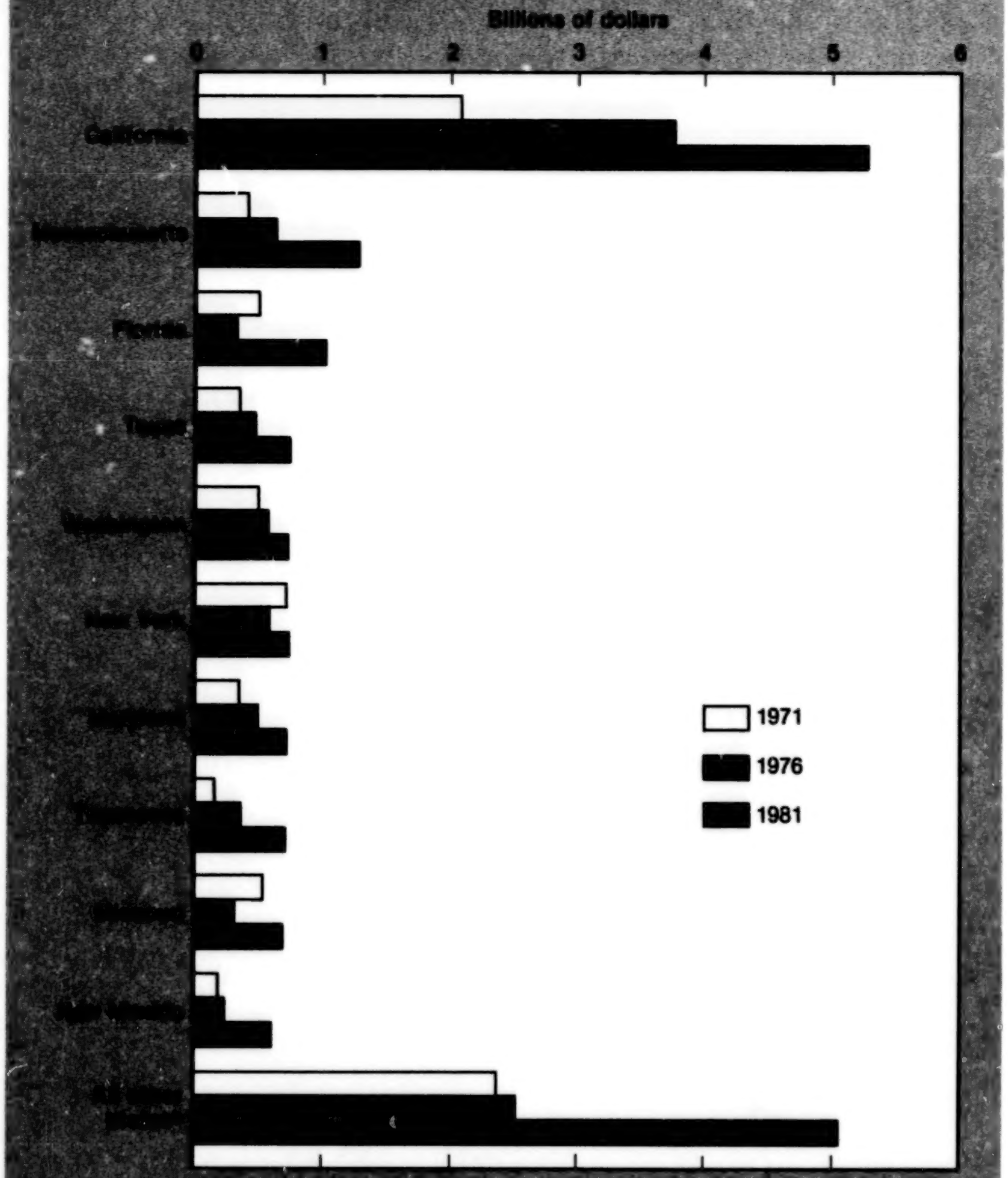
Chart 26. Federal R&D obligations to intramural performers in the 10 states leading in such support in FY 1981 for selected years



^a Includes outlying areas and offices abroad.
SOURCE: National Science Foundation

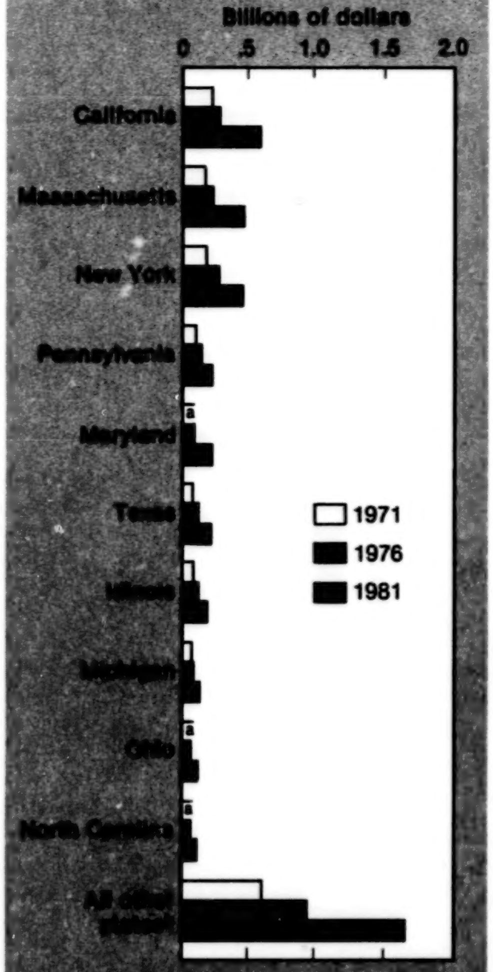
MICROFILMED FROM BEST AVAILABLE COPY

Chart 27. Federal obligations to industrial firms[a] in the 10 States leading in such support in FY 1981 for selected years



[a] Includes industry-funded research and development centers administered by this sector.
[b] Includes outlying areas and offices abroad.
SOURCE: National Science Foundation

Chart 28. Federal R&D obligations to universities and colleges in the 10 States leading in such support in FY 1981 for selected years



[a] Less than $0.05 billion dollars.
[b] Includes outlying areas and offices abroad.
SOURCE: National Science Foundation

years, California led in Federal R&D obligations directed to industry as well as to universities and colleges and their associated FFRDC's, and ranked second in support to Federal intramural activities as well as to nonprofit organizations and their associated FFRDC's. Maryland led all the States in Federal intramural support and was fifth in support to academia. Massachusetts was second to California in support to industry and to universities and colleges, and was first in support to nonprofit institutions and associated FFRDC's.

New Mexico, while ranked seventh for total R&D support and tenth in Federal support to industry, led the States in support to industry-administered FFRDC's and ranked second in level of support to university-administered FFRDC's (entirely because of the location of DOE-supported R&D centers within the State).

Concentrations of Federal R&D obligations among a few States are found in areas where the number of performers of one type is very low. For instance, in 1981 FFRDC's administered by universities were found in only 13 States, and 75 percent of Federal R&D support to these centers was concentrated in the top 10 of the overall leading States. In the case of FFRDC's administered by other nonprofit organizations, 64 percent of the Federal R&D support was directed to the 10 leading States (these centers were in only six of the States).

Table 16. Distribution of Federal R&D obligations by State compared with other national indicators by State: fiscal year 1981

State	Total Federal R&D obligations		Population		Total scientists and engineers		Doctoral scientists and engineers	
	Rank	Percent of total	Rank	Percent of total	Rank	Percent of total	Rank	Percent of total
United States, total	$33,727 million		$229 million[1]		$3,381 thousand		$364 thousand	
California	1	23.62	1	10.55	1	12.07	1	12.15
Maryland	2	8.25	19	1.86	11	2.76	9	3.69
Massachusetts	3	7.22	11	2.52	7	4.11	5	4.42
Florida	4	4.84	7	4.44	10	2.81	13	2.39
New York	5	4.62	2	7.68	2	7.47	2	9.75
Texas	6	3.69	3	6.44	3	6.26	3	4.90
New Mexico	7	3.63	37	.58	30	.95	24	1.17
Virginia	8	3.44	14	2.37	12	2.62	12	2.70
Ohio	9	3.31	6	4.70	6	4.29	8	3.95
Pennsylvania	10	3.21	4	5.18	4	5.06	4	4.79
Washington	11	3.11	20	1.84	14	2.15	16	1.98
District of Columbia	12	2.76	47	.28	21	1.76	10	3.48
Tennessee	13	2.62	14	2.37	22	1.49	21	1.66
Missouri	14	2.43	15	2.15	13	2.20	22	1.66
New Jersey	15	2.30	9	3.22	9	3.68	7	4.40
Colorado	16	1.88	27	1.29	17	2.04	14	2.11
Illinois	17	1.70	5	5.00	5	4.80	6	4.41
Alabama	18	1.70	22	1.71	31	.86	31	.92
Connecticut	19	1.44	25	1.37	18	2.04	17	1.83
Kansas	20	1.40	32	1.04	28	.97	35	.74
Arizona	21	1.09	29	1.22	27	1.02	28	1.06
Michigan	22	1.06	8	4.01	8	3.85	11	3.24
Louisiana	23	.98	18	1.88	23	1.49	25	1.13
Minnesota	24	.92	21	1.79	15	2.13	18	1.78
Utah	25	.91	36	.66	32	.86	34	.80
Nevada	26	.78	43	.37	51	.18	50	.18
North Carolina	27	.77	10	2.60	20	1.77	15	2.09
Georgia	28	.58	12	2.43	24	1.42	23	1.41
Rhode Island	29	.54	41	.42	42	.38	39	.48
Indiana	30	.50	13	2.38	19	1.87	19	1.75
West Virginia	30	.45	34	.85	36	.59	38	.50
Iowa	32	.44	28	1.26	29	.96	32	.92
Wisconsin	33	.39	16	2.07	16	2.09	20	1.69
Mississippi	34	.37	31	1.10	37	.53	37	.62
Idaho	35	.35	40	.42	39	.47	42	.38
Oregon	36	.31	30	1.16	25	1.22	26	1.06
Kentucky	37	.30	23	1.60	34	.77	29	.97
South Carolina	38	.28	24	1.38	33	.84	33	.89
Oklahoma	39	.24	26	1.35	26	1.12	27	1.06
Wyoming	40	.17	50	.21	46	.26	51	.18
New Hampshire	41	.16	42	.41	44	.30	46	.28
Alaska	42	.16	51	.18	49	.21	49	.20
Hawaii	43	.15	39	.43	43	.38	40	.45
Montana	44	.13	44	.35	45	.30	45	.34
North Dakota	45	.12	46	.29	47	.26	47	.23
Nebraska	46	.09	35	.69	35	.61	36	.62
Arkansas	47	.09	33	1.00	40	.44	41	.44
Delaware	48	.08	48	.26	41	.41	30	.93
Maine	49	.09	38	.49	38	.51	43	.37
Vermont	50	.06	49	.23	48	.23	44	.36
South Dakota	51	*	45	.30	50	.19	48	.23
Outlying areas and offices abroad	—	.26	—	—	—	—	—	.26

[1] Provisional estimate of resident population as of July 1, 1981.

SOURCES: Department of Commerce and the National Science Foundation

factors in r&d performing capability

R&D obligations can be ranked by State and compared with such measures of national resources as population, total scientists and engineers, and doctoral scientists and engineers (table 16). Although no direct causal relationships can be inferred, the data indicate that the top 10 recipient R&D States in 1981, with the exception of New Mexico, also had the largest shares of such resources.

Table 17. Federal obligations for R&D plant in the 10 States leading in such support by agency: fiscal year 1981

[Dollars in millions]

	Total	DOE	DOD	NASA	HHS	USDA	DOT	NSF	Interior
Total	$1,454	$978	$278	$116	$24	$21	$19	$15	$ 3
California	355	214	103	28	(1)	2	6	2	—
New Mexico	119	109	10	—	—	(1)	—	—	(1)
Pennsylvania	95	91	3	—	—	1	(2)	—	(1)
Washington	89	87	—	—	1	1	—	1	(1)
Tennessee	86	77	9	—	—	(1)	—	—	—
New York	85	74	8	—	1	1	—	2	—
Nevada	83	83	(1)	—	—	1	—	—	—
Illinois	74	72	(1)	—	(1)	1	—	(1)	—
Ohio	65	25	25	14	—	(1)	1	—	—
New Jersey	56	46	1	—	—	(1)	9	—	—
All other States[2]	347	100	120	73	22	16	4	10	3

[1] Less than $500 thousand.

[2] Includes outlying areas and offices abroad.

SOURCE: National Science Foundation

r&d plant

Of the 10 leading States in Federal R&D support in 1981, 5 ranked within the leading 10 in Federal support for R&D plant. Whereas these States together—California, New Mexico, Pennsylvania, New York and Ohio—accounted for approximately 80 percent of total Federal R&D obligations, they accounted for 49 percent of Federal R&D plant support (table 17).

The 10 leading States in Federal R&D plant support accounted for three-fourths of all Federal R&D plant support.

Of the leading agencies in R&D plant obligations in 1981—DOE, DOD, and NASA—DOE support accounted for 67 percent of the total; DOD, 19 percent; and NASA, 8 percent. In the case of DOD and NASA, data for R&D plant are underreported since much of the cost of R&D plant is included in the R&D costs reported for extramural performers without plant separately broken out. Thus, in most States for which R&D plant obligations are shown, the leading agency is DOE.

California received the largest share of R&D plant support, with approximately 24 percent of the Federal total. DOE accounted for three-fifths of all Federal agency R&D plant obligations to that State, and DOD accounted for almost one-third. Almost two-thirds of the DOE R&D plant support in California was directed to the E. O. Lawrence Laboratories in Livermore and Berkeley, both of which are administered by the University of California.

In Richland, Washington support by DOE for Hanford Engineering Development Laboratory accounted for 81 percent of total R&D plant obligations in that State.

Nevada and Illinois rank among the top 10 recipients of Federal R&D plant obligations. These obligations represent DOE contracts to industry in Nevada and Illinois as well as support to Fermilab, an FFRDC in Illinois.

appendixes

a. technical notes
b. federally funded research
   and development centers
c. statistical tables

NOTE

The *Detailed Statistical Tables* for this volume have been published separately under one cover (NSF 82-326). Included on pp. 44-49 in this volume are detailed statistical tables C-1, C-2, and C-3, as well as a complete listing of all the tables.

The *Detailed Statistical Tables* may be obtained gratis from the National Science Foundation, Washington, D.C. 20550.

appendix a

technical notes

scope and method

During the period March through August 1982 a total of 34 Federal agencies and their subdivisions—96 individual respondents—submitted data in response to the *Annual Survey of Federal Funds for Research and Development,* Volume XXXI, conducted by the National Science Foundation (NSF) and distributed in February and March 1982. In nearly all cases the data received from the agencies were in terms of obligations and outlays incurred, or expected to be incurred, regardless of when the funds were appropriated or whether they were identified in the respondents' budgets specifically for research and development (R&D) activities. The exception was the National Aeronautics and Space Administration (NASA), for which the same kinds of transactions were reported in terms of budget plan, which approximates obligations.

Federal agencies provided R&D data earlier to the Office of Management and Budget (OMB) for inclusion in "Special Analysis K: Research and Development" in *The Budget of the United States Government, Fiscal Year 1983,* which was one of the budget documents presented to the Congress in February 1982. The R&D data in the agency submissions to OMB and to the *Federal Funds* survey were based on the same definitions and are reconcilable, but the data in the *Federal Funds* survey cover smaller R&D support agencies not covered by "Special Analysis K" and are classified in more detailed categories.

definitions

The definitions are essentially unchanged from prior *Federal Funds* surveys.

1. research, development, and r&d plant

This heading includes all direct, indirect, incidental, or related costs resulting from or necessary to research, development, and R&D plant, regardless of whether the research and development are performed by a Federal agency (intramurally) or performed by private individuals and organizations under grant or contract (extramurally). Research and development exclude routine product testing, quality control, mapping and surveys, collection of general-purpose statistics, experimental production, and the training of scientific personnel.

a. **Research** is systematic study directed toward fuller scientific knowledge or understanding of the subject studied. Research is classified as either basic or applied according to the objectives of the sponsoring agency.

In **basic research** the objective of the sponsoring agency is to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

In **applied research** the objective of the sponsoring agency is to gain knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

b. **Development** is systematic use of the knowledge or understanding gained from research, directed toward the production of useful materials, devices, systems, or methods, including design and development of prototypes and processes. It excludes quality control, routine product testing, and production.

c. **R&D plant** (R&D facilities and fixed equipment, such as reactors, wind tunnels, and radio telescopes) includes acquisition of, construction of, major repairs to, or alterations in structures, works, equipment, facilities, or land, for use in R&D activities at Federal or non-Federal installations. Excluded from the R&D plant category are expendable equipment and office furniture and equipment. Obligations for foreign R&D plant are limited to Federal funds for facilities located abroad and used in support of foreign research and development.

2. obligations and outlays

a. **Obligations** represent the amounts for orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when future payment of money is required.

b. **Outlays** represent the amounts for checks issued and cash payments made during a given period, regardless of when the funds were appropriated.

The obligations and outlays reported cover all transactions from all funds available to an agency from direct appropriations, trust funds, or special account receipts, corporate income, or other sources, including funds appropriated by the President, that the agency has received or expects to receive. The amounts reported for each year reflect obligations and outlays for that year, regardless of when the funds were originally authorized or received and regardless of whether they were appropriated, received, or identified in the agency's budget specifically for research, development, or R&D plant.

An agency making a transfer of funds to another agency includes such transfers in its report of obligations and outlays. The receiving agency does not report, for purposes of this survey, funds transferred to it from another agency. Similarly, a subdivision of an agency that transfers funds to another subdivision within that agency reports such obligations or outlays as its own.

Obligations and outlays for work performed in foreign countries include funds directly available to Federal agencies and special foreign currencies separately appropriated. The latter currencies are derived largely from provisions of Public Law 480, 1954, as amended.

3. cost coverage

Funds reported for research and development reflect full costs. In addition to costs of specific R&D projects, the applicable overhead costs are also included. The amounts reported include the costs of planning and administering R&D programs, laboratory overhead, pay of military personnel, and departmental administration.

4. fiscal year

The fiscal year in the Federal Government accounting period begins October 1 of a given year and ends September 30 of the following year; thus, fiscal year (FY) 1981 began on October 1, 1980, and ended September 30, 1981.

5. agency

An agency is an organization of the Federal Government whose principal executive officer reports to the President. The only exception is the Library of Congress, also included in the survey, whose executive officer reports to the Congress. The term subdivision refers to any major organizational unit of a reporting agency, such as a bureau, administration, office, or service.

6. performers

Performers are either intramural organizations accomplishing operating functions or extramural organizations or persons receiving support or providing services under a contract or grant.

a. **Intramural performers:** Agencies of the Federal Government. Their work is carried on directly by their own personnel. Obligations reported under this category are for activities performed directly by a reporting agency, or they represent funds that the agency transfers to another Federal agency for performance of work. The ultimate performer must be a Federal agency. If the ultimate performer is *not* a Federal agency, the funds so transferred are reported by the transferring agency under the appropriate extramural performer category (industrial firms, universities and colleges, other nonprofit institutions, etc.). Intramural performance includes the costs of supplies and equipment, essentially of an "off-the-shelf" nature, that are procured for use in intramural research and development. The cost of Federal personnel engaged in planning and administering intramural and extramural R&D programs is also included as part of the intramural performance total.

b. **Extramural performers:** All organizations outside the Federal sector that perform with Federal funds under contract or grant. Only those costs associated with actual extramural R&D performance are reported, but these would include costs of materials and supplies to carry out R&D activities. Costs of "off-the-shelf" supplies and equipment procured from extramural suppliers and required to support intramural research and development are considered as part of the costs of intramural performance and not as part of the costs of extramural performance. Extramural performers are identified as follows:

i. **Industrial firms:** Those organizations that may legally distribute net earnings to individuals or to other organizations.

ii. **Universities and colleges:** Institutions engaged primarily in providing resident and/or accredited instruction for at least a 2-year program above the secondary school level. Included are colleges of liberal arts; schools of arts and sciences; professional schools, as in engineering and medicine, including affiliated hospitals; associated research institutes; and agricultural experiment stations.

iii. **Other nonprofit institutions:** Private organizations other than educational institutions, no part of whose net earnings inure to the benefit of a private stockholder or individual, and other private organizations organized for the exclusive purpose of turning over their entire net earnings to such nonprofit institutions.

iv. **Federally funded research and development centers (FFRDC's):** R&D-performing organizations exclusively or substantially financed by the Federal Government that are supported by the Federal Government either to meet a particular R&D objective or, in some instances, to provide major facilities at universities for research and associated training purposes. Each center is administered either by an industrial firm, a university, or another nonprofit institution.

In general, all of the following criteria are met by an organization before it is included in the FFRDC category: (1) Its primary activities include one or more of the following: basic research, applied research, development, or management of research and development (specifically excluded are organizations engaged primarily in routine quality control and testing, routine service activities, production, mapping and surveys, and information dissemination); (2) it is a separate operational unit within the parent organization or is organized as a separately incorporated organization; (3) it performs actual research and development or R&D management either upon direct request of the Federal Government or under a broad charter from the Federal Government, but in either case under the direct monitorship of the Federal

Government; (4) it receives its major financial support (70 percent or more) from the Federal Government, usually from one agency; (5) it has, or is expected to have, a long-term relationship with its sponsoring agency (about five years or more), as evidenced by specific obligations assumed by it and the agency; (6) most or all of its facilities are owned by or are funded under contract with the Federal Government; and (7) it has an average annual budget (operating and capital equipment) of at least $500,000.

FFRDC's are grouped into four categories, research laboratories, R&D laboratories, study and analysis centers, and system engineering/system integration centers, according to their primary activity to reflect the differences in the nature and activities of the centers.[1]

Research laboratories are principally used for the pursuit of research (as distinguished from development). Most concentrate on basic research in one particular area and many provide major, unique, research facilities for national use.

R&D laboratories engage in various facets of the research and development process. Most are multiprogram laboratories active in a variety of science and/or engineering areas, though some specialize in a broad functional area such as national security or nuclear energy. Most of these institutions contain major national research and/or testing facilities.

Study and analysis centers are involved exclusively in analytical activities; no hardware related laboratory research or development is carried out.

System engineering/system integration centers primarily provide systems engineering, R&D system integration and management support for definition and development of large technical systems.

v. **State and local governments:** State and local government agencies, excluding State and local universities and colleges, agricultural experiment stations, medical schools, and affiliated hospitals. (Federal R&D funds obligated directly to such State and local educational institutions are included under the universities- and -colleges category in this survey.) Research and development under the State and local government category are performed either directly by State or local agencies or by other organizations under grant or contract from such agencies. Regardless of the ultimate performer, Federal R&D funds directed to State and local government are reported under the State and local government category, and no other.

vi. **Foreign performers:** Foreign citizens, organizations, or governments, as well as international organizations, such as NATO, UNESCO, and WHO, performing work abroad financed by the Federal Government. Excluded are payments to U.S. agencies, organizations, or citizens performing research and development abroad for the Federal Government; the survey does not seek information on "offshore" payments. Also excluded are payments to foreign scientists performing in the United States.

vii. **Private individuals:** Individuals receiving a Federal R&D grant or contract award directly; in this case obligations are reported under "industrial firms."

7. fields of science

The fields of science in this survey are divided into eight broad field categories, each of them consisting of a number of detailed fields. The broad fields are life sciences, psychology, physical sciences, environmental sciences, mathematics and computer sciences, engineering, social sciences, and other sciences not elsewhere classified. The following listing presents the fields grouped under each of the broad fields, together with illustrative disciplines.

a. **Life sciences** consist of five detailed fields: biological (excluding environmental), environmental biology, agricultural, medical, and life sciences not elsewhere classified. The illustrative disciplines provided below under each of these detailed fields are not intended to be sharp definitions; they represent examples of disciplines generally classified under a given detailed field. A discipline, however, may be classified under another detailed field when the major emphasis is elsewhere. Research in biochemistry could be reported as biological, agricultural, or medical, depending on the orientation of the project. Human biochemistry would be classified under biological, but animal biochemistry or plant biochemistry would be under agricultural. Examples of disciplines under each of the detailed fields are as follows:

Biological (excluding environmental): anatomy; biochemistry; biology; biometry and biostatistics; biophysics; botany; cell biology; entomology and parasitology; genetics; microbiology; neuroscience (biological); nutrition; physiology; zoology; other biological, n.e.c.[2]

Environmental biology: ecosystem sciences; evolutionary biology; limnology; physiological ecology; population biology; population and biotic community ecology; systematics; other environmenal biology, n.e.c.[2]

Agricultural: agronomy; animal sciences; food science and technology; fish and wildlife; forestry; horticulture; plant sciences; soils and soil science; phytopathology; phytoproduction; agriculture, general; other agriculture, n.e.c.[2]

Medical: internal medicine; neurology; obstetrics and gynecology; ophthalmology; otolaryngology; pediatrics; preventive medicine; pathology; pharmacology; psychiatry; radiology; surgery; dentistry; pharmacy; veterinary medicine; other medical, n.e.c.[2]

Life sciences, n.e.c.[2]

b. **Psychology** deals with behavior, mental processes, and individual and group characteristics and abilities. Psychology is divided into three categories: biological aspects, social aspects, and psychological sciences not elsewhere classified. Examples of disciplines under each of these fields are as follows:

Biological aspects: experimental psychology; animal behavior; clinical psychology; comparative psychology; ethology.

Social aspects: social psychology; education, personnel, vocational psychology, and testing; industrial and engineering psychology; development and personality.

Psychological sciences, n.e.c.[2]

---

[1] The categories were established in December 1982 by a Task Force of representatives of agencies responsible for FFRDC's at the request of the Office of Science and Technology Policy.

[2] Not elsewhere classified: Includes multidisciplinary projects within a broad field and single-discipline projects for which a separate field has not been assigned.

c. **Physical sciences** are concerned with understanding of the material universe and its phenomena. They comprise the fields of astronomy, chemistry, physics, and physical sciences not elsewhere classified. Examples of disciplines under each of these fields are as follows:

Astronomy: laboratory astrophysics; optical astronomy; radio astronomy; theoretical astrophysics; X-ray, Gamma-ray, neutrino astronomy.

Chemistry: inorganic; organo-metallic; organic; physical.

Physics: acoustics; atomic and molecular; condensed matter; elementary particle; nuclear structure; optics; plasma.

Physical sciences, n.e.c.[2]

d. **Environmental sciences** (terrestrial and extraterrestrial) are concerned (with one exception) with the gross nonbiological properties of the areas of the solar system that directly or indirectly affect man's survival and welfare; they comprise the fields of atmospheric sciences, geological sciences, oceanography, and environmental sciences not elsewhere classified. The one exception is that obligations for studies pertaining to life in the sea, or other bodies of water, are reported as support of oceanography and not biology. Examples of disciplines under each of these fields are as follows:

Atmospheric sciences: aeronomy; solar; weather modification; extraterrestrial atmospheres; meteorology.

Geological sciences: engineering geophysics; general geology; geodesy and gravity; geomagnetism; hydrology; inorganic geochemistry; isotopic geochemistry; organic geochemistry; laboratory geophysics; paleomagnetism; paleontology; physical geography and cartography; seismology; soil sciences.

Oceanography: biological oceanography; chemical oceanography; physical oceanography; marine geophysics.

Environmental sciences, n.e.c.[2]

e. **Mathematics and computer sciences** employ logical reasoning with the aid of symbols and are concerned with the development of methods of operation employing such symbols, and in the case of computer sciences, with the application of such methods to automated information systems. Examples of disciplines under each of these fields are as follows:

Mathematics: algebra; analysis; applied mathematics; foundations and logic; geometry; numerical analysis; statistics; topology.

Computer sciences: programming languages; computer and information sciences (general); design development, and application of computer capabilities to data storage and manipulation; information sciences and systems; systems analysis.

Mathematics and computer sciences, n.e.c.[2]

f. **Engineering** is concerned with studies directed toward developing engineering principles or toward making specific scientific principles usable in engineering practice. Engineering is divided into eight fields: aeronautical, astronautical, chemical, civil, electrical, mechanical, metallurgy and materials, and engineering not elsewhere classified. Examples of disciplines under each of these fields are as follows:

Aeronautical: aerodynamics.

Astronautical: aerospace; space technology.

Chemical: petroleum; petroleum refining; process.

Civil: architectural; hydraulic, hydrologic; marine; sanitary and environmental; structural; transportation.

Electrical: communication; electronic; power.

Mechanical: engineering mechanics.

Metallurgy and materials: ceramic; mining; textile; welding.

Engineering, n.e.c.[2] agricultural; industrial and management; nuclear; ocean engineering systems.

g. **Social sciences** are directed toward an understanding of the behavior of social institutions and groups and of individuals as members of a group. These sciences include anthropology, economics, political science, sociology, and social sciences not elsewhere classified. Examples of disciplines under each of these fields are as follows:

Anthropology: archaeology; cultural and personality; social and ethnology; applied anthropology.

Economics: econometrics and economic statistics; history of economic thought; international economics; industrial, labor, and agricultural economics; macroeconomics; microeconomics; public finance and fiscal policy; theory; economic systems and development.

Political science: area or regional studies; comparative government; history of political ideas; international relations and law; national political and legal systems; political theory; public administration.

Sociology: comparative and historical; complex organizations; culture and social structure; demography; group interactions, social problems and social welfare; sociological theory.

Social sciences, n.e.c.:[2] linguistics; research in education; research in history; socioeconomic geography; research in law, e.g., attempts to assess the impact on society of legal systems and practices.

h. **Other sciences not elsewhere classified** includes multidisciplinary and interdisciplinary projects that cannot be classified within one of the broad fields of science.

8. geographic distribution of 1981 r&d obligations

a. Ten agencies participated in the survey covering the geographic distribution of obligations for research and development and R&D plant. These ten agencies accounted for 97 percent of total Federal R&D and R&D plant obligations in 1981. The respondents were the Departments of Agriculture (USDA); Commerce; Defense (DOD); Energy (DOE); Health and Human Services (HHS); the Interior; and Transportation (DOT); the Environmental Protection Agency (EPA); the National Aeronautics and Space Administration (NASA); and NSF.

b. Data were requested for the "actual" year 1981 in terms of the principal location (State or outlying area) where the work was performed by the prime contractor, grantee, or intramural organization. When this information was not available in their records, the respondents were asked to assign the obligations to the State, outlying area, or office abroad where the headquarters of the U.S. prime contractor, grantee, or intramural organization was located.

c. Obligations were reported for research and development as a combined amount.

d. Specifically omitted from the geographic survey were R&D obligations to foreign performers and obligations for R&D plant used in support of foreign performers. Foreign performer data, by country, are reported in another part of the *Federal Funds* survey.

changes in reporting

Responses from the agencies in this survey, as in the previous ones, reflect revisions of estimates for the latest two years of the previous report, in this case fiscal years 1981 and 1982. Such revision is part of the budgetary cycle. From time to time responses also reflect reappraisals and revisions in classification of various aspects of agencies' R&D programs. When this occurs, NSF requires the agencies to provide revised prior-year data to maintain consistency and comparability with the most recent concepts.

limitations of the data

Funds for research and development were reported on a 3-year basis comparable with the 1983 budget, upon which the data were based. The respondents reconciled the data reported to the *Federal Funds* survey with amounts for research and development provided to OMB for the 1983 budget. The amounts reported for each year, as already stated, are the obligations or outlays incurred in that year, regardless of when the funds were authorized or received by an agency and regardless of whether the funds were identified in the agency's budget specifically for research, development, and/or R&D plant.

Data submitted by the Federal agencies for 1981 are considered to be actual since they represent virtually completed transactions. Amounts reported for 1982 and 1983 are estimates in that they are subject to further appropriation, apportionment, or deferral decisions. The effects of these and other, later actions on 1982 and 1983 outlays and obligations will be reflected in the next report.

Respondent judgment is often necessary in classifying the data. Most agency R&D programs must be separated by agency respondents from other, larger programs because they are not identified as budget-line items. R&D programs, once identified, must then be further subdivided into the survey categories: basic research, applied research, development, performers, and fields of science. Over the years, however, the participating agencies have developed increasing skill and consistency in meeting the survey requirements.

Some agencies have not been able to report the full cost of research and development. For example, the headquarters costs of planning and administering R&D programs of DOD (estimated at a fraction of 1 percent of the DOD R&D total) are not included because this agency has stated that identification of the amounts is impracticable.

R&D plant data are also to some extent underreported because of the difficulty encountered by some agencies, particularly DOD and NASA, in identifying and reporting these data. While DOD reports obligations for R&D plant under the construction appropriation, DOD is able to identify only a small portion of the R&D plant support within R&D contracts that are funded from the RDT&E appropriation. NASA cannot separately identify those portions of industrial R&D contracts applicable to R&D plant but subsumes R&D plant data in the R&D data covering industrial performance; R&D plant data for other NASA performing sectors can be, and are, reported.

relation to other reports

1. federal support to universities and colleges

NSF conducts a separate survey covering Federal support to individual universities and colleges. This survey is based on data provided by the Federal agencies under the reporting system established by the former Committee on Academic Science and Engineering (CASE) of the Federal Council for Science and Technology. The reports resulting from these surveys are entitled *Federal Support to Universities, Colleges, and Selected Nonprofit Institutions* and are referred to as the CASE reports.

Both the CASE and *Federal Funds* reports provide data on Federal obligations for research and development and R&D plant to universities and colleges and to university-administered FFRDC's. The CASE report, however, is based on obligations of Federal agencies to each *individual* academic institution, whereas the *Federal Funds* report is concerned with obligations to universities and colleges as a performer *group*. The CASE report additionally includes funds for non-R&D activities, such as science education and nonscience support. Further, the CASE survey is based on reports of only 15 agencies (USDA; Commerce; DOD; the Department of Education, Energy, HHS, Housing and Urban Development, Interior, and Labor; DOT; EPA; NASA; NSF; the Agency for International Development; and the Nuclear Regulatory Commission) whereas the *Federal Funds* survey is composed of obligations of all agencies with R&D programs. The 15 respondents to CASE, however, account for more than 99 percent of total Federal R&D support to universities and colleges and all obligations to university-administered FFRDC's.

The different reporting procedures have led to the reporting of different totals to the CASE and *Federal Funds* surveys, as follows:

a. The obligations for research and development to universities and colleges reported for *Federal Funds* in 1981 amounted to $4,478 million, or $69 million more than the amount reported for CASE.

b. The R&D obligation total for university-administered FFRDC's, as reported to *Federal Funds*, was $1,829 million in 1981, or $4 million more than reported for CASE. For *Federal Funds* $195 million subcontracted by the NASA university-administered Jet Propulsion Laboratory was included in ultimate-performer categories, whereas for CASE the subcontracted amount was included in the R&D obligations to FFRDC's administered by universities.

c. Total R&D plant obligations to universities and colleges reported to the *Federal Funds* survey were $37 million in 1981, or $7 million more than the amount reported to the CASE survey.

d. Total R&D plant obligations to university-administered FFRDC's, as reported to *Federal Funds,* were $371 million in 1981, or $49 million more than reported to CASE.

The following factors should also be considered in comparing the data appearing in the two reports:

For *Federal Funds* each agency includes as part of its obligations the amounts transferred to other agencies for R&D activities. A receiving agency does not report funds transferred from another agency. In the CASE survey, by contrast, the data are reported by the agency that makes the *final* distribution of the funds to a given institution. Thus, for the CASE survey, agencies include funds received from other agencies and exclude funds transferred to other agencies, the reverse of the *Federal Funds* process. Although such transfers should balance each other out with no resulting changes in total R&D obligations, these different reporting requirements add to the possibility of differences between the two reports.

The CASE responses are in many cases prepared by different operating units within the agencies from those that prepare the *Federal Funds* responses. The CASE data are also collected several months earlier than the *Federal Funds* data. Theoretically, these conditions should not add to reporting differences, but in practice differences do arise.

2. special analyses, budget of the united states

In a section of *Special Analyses, Budget of the United States Government,* OMB publishes estimates of obligations and outlays for research, development, and R&D plant. These data, as shown in "Special Analysis K: Research and Development" in the original 1983 budget, did not provide as much detail on character of work as *Federal Funds* data, and they did not include information on performers, fields of science, or geographic distribution.

"Special Analysis K" and *Federal Funds* utilized the same definitions for research and development and for R&D plant. The estimates for research and development published in the two reports are comparable, even though minor differences exist. The comparison between the two reports is as follows:

Total Federal R&D obligations
(Billions of dollars)

	FY 1981	FY 1982	FY 1983
Federal Funds . .	$34.9	$39.0	$43.0
Special Analysis K . .	35.0	38.8	43.0

3. federal r&d funding by budget function: fiscal years 1981-83

NSF published a special report under the above title, providing an analysis of Federal R&D programs by budget function categories. The *Federal Funds,* Volume XXXI survey, by contrast, reported on R&D funding by agencies rather than by functional categories. The *Federal Funds* report provided obligational data rather than budget authority data, which formed the basis for the function report. The R&D budget authority data for 1981-83 in the function report were based on information provided to OMB by the agencies as background for "Special Analysis K" in the 1983 budget. Further program information was based on budget justification documents of the leading R&D support agencies and information provided directly to NSF by some of the smaller agencies.

4. other reports

a. Agencies may classify their R&D programs for purposes other than those for which the *Federal Funds* survey is conducted. Definitions and guidelines that are suitable to these other purposes may result in information that is not comparable with the data transmitted to NSF for *Federal Funds.*

appendix b

federally funded research and development centers, fiscal years 1981-83

Note: Total Federal obligations for R&D and R&D plant support to each FFRDC in fiscal year 1981 is shown in parentheses. The overall total is $4,400,132,000.

department of defense

office of the secretary of defense

Administered by other nonprofit institutions:

Institute for Defense Analyses (IDA), Arlington, Virginia ($14,549,000)

department of the navy

Administered by universities and colleges:

Center for Naval Analyses (University of Rochester), Arlington, Virginia ($15,441,000)

department of the air force

Administered by universities and colleges:

Lincoln Laboratory (Massachusetts Institute of Technology), Lexington, Massachusetts ($137,751,000)

Administered by other nonprofit institutions:

Aerospace Corporation, El Segundo, California ($189,684,000)

C^3 Division (MITRE Corporation),[3] Bedford, Massachusetts ($105,707,000)

Project Air Force (RAND Corporation),[4] Santa Monica, California ($13,947,000)

department of health and human services

national institutes of health

Administered by industrial firms:

Frederick Cancer Research Center (Litton Bionetics, Inc., Litton Industries), Frederick, Maryland ($26,366,000)

department of energy

Administered by industrial firms:

Bettis Atomic Power Laboratory (Westinghouse Electric Corp.), Pittsburgh, Pennsylvania ($239,505,000)

Energy Technology Engineering Center (Rockwell International Corporation), Santa Susana, California ($37,143,000)

Hanford Engineering Development Laboratory (Westinghouse-Hanford Corp.), Richland, Washington ($193,943,000)

Idaho National Engineering Laboratory (EG&G Idaho, Inc.; Exxon Nuclear Idaho Co.; Argonne National Laboratory, West; Westinghouse Electric Corp.), Idaho Falls, Idaho ($149,200,000)

Knolls Atomic Power Laboratory (General Electric Company), Schenectady, New York ($195,478,000)

Mound Laboratory (Monsanto Research Corp.), Miamisburg, Ohio ($13,995,000)

Oak Ridge National Laboratory (Union Carbide Corp.), Oak Ridge, Tennessee ($255,800,000)

Sandia National Laboratories (Western Electric Co., Inc.-Sandia Corp.), Albuquerque, New Mexico ($507,929,000)

Savannah River Laboratory (E.I. duPont de Nemours & Co., Inc.), Aiken, South Carolina ($41,084,000)

Administered by universities and colleges:

Ames Laboratory (Iowa State University of Science and Technology), Ames, Iowa ($17,520,000)

---

[3] Only the C^3 Division of the MITRE Corporation is reported as an FFRDC. All other agency support to MITRE is reported under "other nonprofit institutions excluding FFRDC's."

[4] Only the Project Air Force portion of the RAND Corporation is reported as an FFRDC. All other agency support to RAND is reported under "nonprofit institutions excluding FFRDC's."

MICROFILMED FROM BEST AVAILABLE COPY

Argonne National Laboratory (University of Chicago and Argonne Universities Assn.), Argonne, Illinois	($223,300,000)
Brookhaven National Laboratory (Associated Universities, Inc.), Upton, Long Island, New York	($179,392,000)
E. O. Lawrence Berkeley Laboratory (University of California), Berkeley, California	($120,867,000)
E. O. Lawrence Livermore National Laboratory (University of California), Livermore, California	($506,395,000)
Fermilab (Universities Research Association, Inc.), Batavia, Illinois	($120,266,000)
Los Alamos National Laboratory (University of California), Los Alamos, New Mexico	($424,221,000)
Oak Ridge Institute of Nuclear Studies (Oak Ridge Associated Universities), Oak Ridge, Tennessee	($24,414,000)
Plasma Physics Laboratory (Princeton University), Princeton, New Jersey	($105,627,000)
Stanford Linear Accelerator Center (Stanford University), Stanford, California	($64,497,000)

Administered by other nonprofit institutions:

Pacific Northwest Laboratory (Battelle Memorial Institute), Richland, Washington	($106,036,000)
Solar Energy Research Institute (Midwest Research Institute), Golden, Colorado	($110,373,000)

national aeronautics and space administration

Administered by universities and colleges:

Jet Propulsion Laboratory (California Institute of Technology), Pasadena, California	($188,153,000)

national science foundation

Administered by universities and colleges:

Cerro Tololo Inter-American Observatory (Association of Universities for Research in Astronomy, Inc.), La Serena, Chile	($6,052,000)
Kitt Peak National Observatory (Association of Universities for Research in Astronomy, Inc.), Tucson, Arizona	($11,103,000)
National Astronomy and Ionosphere Center (Cornell University), Arecibo, Puerto Rico	($5,407,000)
National Center for Atmospheric Research (University Corporation for Atmospheric Research), Boulder, Colorado	($32,337,000)
National Radio Astronomy Observatory (Associated Universities, Inc), Green Bank, West Virginia	($14,790,000)
Sacramento Peak Observatory (Association of Universities for Research in Astronomy, Inc.), Sunspot, New Mexico	($1,860,000)

categories of ffrdc's[5]

Total of Federal obligations for R&D and R&D plant support to each FFRDC is shown in parentheses and for each category, in brackets. The overall total is $4,400,132,000.

research laboratories ($282,678,000)

DOE: Fermilab	($120,266,000)
DOE: Stanford Linear Accelerator	($64,497,000)
HHS/NIH: Frederick Cancer Research Center	($26,366,000)
NSF: Cerro Tololo Inter-American Observatory	($6,052,000)
NSF: Kitt Peak National Observatory	($11,103,000)
NSF: National Astronomy and Ionosphere Center	($5,407,000)
NSF: National Center for Atmospheric Research	($32,337,000)
NSF: National Radio Astronomy Observatory	($14,790,000)
NSF: Sacramento Peak Observatory	($1,860,000)

r&d laboratories ($3,778,126,000)

DOD/AF: Lincoln Laboratory	($137,751,000)
DOE: Ames Laboratory	($17,520,000)
DOE: Argonne National Laboratory	($223,300,000)
DOE: Bettis Atomic Power Laboratory	($239,505,000)
DOE: Brookhaven National Laboratory	($179,392,000)
DOE: E.O. Lawrence Berkeley Laboratory	($120,867,000)
DOE: E.O. Lawrence Livermore National Laboratory	($506,395,000)
DOE: Energy Technology Engineering Center	($37,143,000)
DOE: Hanford Engineering Development Laboratory	($193,943,000)
DOE: Idaho National Engineering Laboratory	($149,200,000)
DOE: Knolls Atomic Power Laboratory	($195,478,000)
DOE: Los Alamos National Laboratory	($424,221,000)
DOE: Mound Laboratory	($13,995,000)
DOE: Oak Ridge Institute of Nuclear Studies	($24,414,000)
DOE: Oak Ridge National Laboratory	($255,800,000)
DOE: Pacific Northwest Laboratory	($106,036,000)
DOE: Plasma Physics Laboratory	($105,627,000)
DOE: Sandia National Laboratories	($507,929,000)
DOE: Savannah River Laboratory	($41,084,000)
DOE: Solar Energy Research Institute	($110,373,000)
NASA: Jet Propulsion Laboratory	($188,153,000)

study and analysis centers ($43,937,000)

DOD/AF: Project Air Force	($13,947,000)
DOD/Navy: Center for Naval Analysis	($15,441,000)
DOD/OSD: Institute of Defense Analysis	($14,549,000)

system engineering/system integration centers ($295,391,000)

DOD/AF: Aerospace Corporation	($189,684,000)
DOD/AF: C^3 Division of MITRE	($105,707,000)

---

[5] Categories are defined in the Technical Notes under Performer: FFRDC's.

appendix c

detailed statistical tables

Detailed Statistical Tables for Volume XXX have been published separately (NSF 81-325). Only tables C-1, C-2, and C-3 are included in this report, pp. 44-49.

Research, Development, and R&D Plant

C-1. Overall summary: FY 1981, 1982, and 1983
C-2. By agency: FY 1981, 1982, and 1983

Research and Development—Agency, Character of Work, and Performer

C-3. By agency: FY 1981, 1982, and 1983
C-4. By agency and character of work: FY 1981
C-5. By agency and character of work: FY 1982 (est.)
C-6. By agency and character of work: FY 1983 (est.)
C-7. By agency and performer: FY 1981
C-8. By agency and performer: FY 1982 (est.)
C-9. By agency and performer: FY 1983 (est.)
C-10. Federal obligations for research, development, and R&D plant to federally funded research and development centers, by agency: FY 1981
C-11. Federal obligations for research, development, and R&D plant to federally funded research and development centers, by agency: FY 1982 (est.)
C-12. Federal obligations for research, development, and R&D plant to federally funded research and development centers, by agency: FY 1983 (est.)
C-13. Federal obligations for research, development, and R&D plant to federally funded research and development centers (FFRDC's) by individual FFRDC and agency: FY 1981

Total Research—Agency, Performer, and Field of Science

C-14. By agency and performer: FY 1981
C-15. By agency and performer: FY 1982 (est.)
C-16. By agency and performer: FY 1983 (est.)
C-17. By detailed field of science: FY 1981, 1982, and 1983
C-18. By agency and field of science: FY 1981
C-19. By agency and field of science: FY 1982 (est.)
C-20. By agency and field of science: FY 1983 (est.)
C-21. Psychology and life sciences, by agency and detailed field of science: FY 1981
C-22. Psychology and life sciences, by agency and detailed field of science: FY 1982 (est.)
C-23. Psychology and life sciences, by agency and detailed field of science: FY 1983 (est.)
C-24. Physical and environmental sciences, by agency and detailed field of science: FY 1981
C-25. Physical and environmental sciences, by agency and detailed field of science: FY 1982 (est.)
C-26. Physical and environmental sciences, by agency and detailed field of science: FY 1983 (est.)
C-27. Engineering, by agency and detailed field of science: FY 1981
C-28. Engineering, by agency and detailed field of science: FY 1982 (est.)
C-29. Engineering, by agency and detailed field of science: FY 1983 (est.)
C-30. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1981
C-31. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1982 (est.)
C-32. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1983 (est.)

Basic Research—Agency, Performer, and Field of Science

C-33. By agency and performer: FY 1981

MICROFILMED FROM BEST AVAILABLE COPY

C-34. By agency and performer: FY 1982 (est.)
C-35. By agency and performer: FY 1983 (est.)
C-36. By detailed field of science: FY 1981, 1982, and 1983
C-37. By agency and field of science: FY 1981
C-38. By agency and field of science: FY 1982 (est.)
C-39. By agency and field of science: FY 1983 (est.)
C-40. Psychology and life sciences, by agency and detailed field of science: FY 1981
C-41. Psychology and life sciences, by agency and detailed field of science: FY 1982 (est.)
C-42. Psychology and life sciences, by agency and detailed field of science: FY 1983 (est.)
C-43. Physical and environmental sciences, by agency and detailed field of science: FY 1981
C-44. Physical and environmental sciences, by agency and detailed field of science: FY 1982 (est.)
C-45. Physical and environmental sciences, by agency and detailed field of science: FY 1983 (est.)
C-46. Engineering, by agency and detailed field of science: FY 1981
C-47. Engineering, by agency and detailed field of science: FY 1982 (est.)
C-48. Engineering, by agency and detailed field of science: FY 1983 (est.)
C-49. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1981
C-50. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1982 (est.)
C-51. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1983 (est.)

Applied Research—Agency, Performer, and Field of Science

C-52. By agency and performer: FY 1981
C-53. By agency and performer: FY 1982 (est.)
C-54. By agency and performer: FY 1983 (est.)
C-55. By detailed field of science: FY 1981, 1982, and 1983
C-56. By agency and field of science: FY 1981
C-57. By agency and field of science: FY 1982 (est.)
C-58. By agency and field of science: FY 1983 (est.)
C-59. Psychology and life sciences, by agency and detailed field of science: FY 1981
C-60. Psychology and life sciences, by agency and detailed field of science: FY 1982 (est.)
C-61. Psychology and life sciences, by agency and detailed field of science: FY 1983 (est.)
C-62. Physical and environmental sciences, by agency and detailed field of science: FY 1981
C-63. Physical and environmental sciences, by agency and detailed field of science: FY 1982 (est.)
C-64. Physical and environmental sciences, by agency and detailed field of science: FY 1983 (est.)
C-65. Engineering, by agency and detailed field of science: FY 1981
C-66. Engineering, by agency and detailed field of science: FY 1982 (est.)
C-67. Engineering, by agency and detailed field of science: FY 1983 (est.)
C-68. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1981
C-69. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1982 (est.)
C-70. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1983 (est.)

Development—Agency and Performer

C-71. By agency and performer: FY 1981
C-72. By agency and performer: FY 1982 (est.)
C-73. By agency and performer: FY 1983 (est.)

R&D Plant

C-74. By agency: FY 1981, 1982, and 1983
C-75. By agency and performer of the R&D the plant supports: FY 1981
C-76. By agency and performer of the R&D the plant supports: FY 1982 (est.)
C-77. By agency and performer of the R&D the plant supports: FY 1983 (est.)

Total Research Performed at Universities and Colleges—Agency and Field of Science

C-78. By detailed field of science: FY 1981, 1982, and 1983
C-79. By agency and field of science: FY 1981
C-80. Psychology and life sciences, by agency and detailed field of science: FY 1981
C-81. Physical and environmental sciences, by agency and detailed field of science: FY 1981
C-82. Engineering, by agency and detailed field of science: FY 1981
C-83. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1981

Basic Research Performed at Universities and Colleges—Agency and Field of Science

C-84. By detailed field of science: FY 1981, 1982, and 1983
C-85. By agency and field of science: FY 1981
C-86. Psychology and life sciences, by agency and detailed field of science: FY 1981
C-87. Physical and environmental sciences, by agency and detailed field of science: FY 1981
C-88. Engineering, by agency and detailed field of science: FY 1981
C-89. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1981

Applied Research Performed at Universities and Colleges—Agency and Field of Science

C-90. By detailed field of science: FY 1981, 1982, and 1983
C-91. By agency and field of science: FY 1981
C-92. Psychology and life sciences, by agency and detailed field of science: FY 1981
C-93. Physical and environmental sciences, by agency and detailed field of science: FY 1981
C-94. Engineering, by agency and detailed field of science: FY 1981
C-95. Mathematics and computer sciences and social sciences, by agency and detailed field of science: FY 1981

Foreign Performers—Research and Development

C-96. By region, country, and agency: FY 1981

Foreign Performers—Basic Research

C-97. By region, country, and agency: FY 1981

Special Foreign Currency Program

C-98. For research and development, by agency: FY 1981, 1982, and 1983
C-99. For basic research, by agency: FY 1981, 1982, and 1983
C-100. For applied research, by agency: FY 1981, 1982, and 1983
C-101. For development, by agency: FY 1981, 1982, and 1983

Geographic Distribution—Research and Development and R&D Plant

C-102. Research, development, and R&D plant, by geographic division and State: FY 1981
C-103. Research and development, by State and performer: FY 1981
C-103A. Percent distribution to each performer, by State: FY 1981

MICROFILMED FROM BEST AVAILABLE COPY

C-103B. Percent distribution to each State, by performer: FY 1981
C-104. Research and development, by State and agency: FY 1981
C-104A. Percent distribution of each agency, by State: FY 1981
C-104B. Percent distribution of each State, by agency: FY 1981
C-105. Research and development, by geographic division, State, agency, and performer: FY 1981
C-106. R&D plant, by geographic division, State, and performer supported: FY 1981
C-107. R&D plant, by geographic division, State, and agency: FY 1981

Federal Intramural Personnel Costs

C-108. Total research and development, by agency: FY 1981, 1982, and 1983
C-109. Basic research, by agency: FY 1981, 1982, and 1983
C-110. Applied research, by agency: FY 1981, 1982, and 1983
C-111. Development, by agency: FY 1981, 1982, and 1983

Historical Data

OUTLAYS

C-112. Research, development, and R&D plant, by agency: FY 1973-83
C-113. Research and development, by agency: FY 1973-83
C-114. R&D plant, by agency: FY 1973-83

OBLIGATIONS

C-115. Research, development, and R&D plant, by agency: FY 1973-83
C-116. Research and development, by agency: FY 1973-83
C-117. R&D plant, by agency: FY 1973-83
C-118. Research and development, by character of work and R&D plant: FY 1973-83
C-119. Total research, by selected agency: FY 1973-83
C-120. Basic research, by selected agency: FY 1973-83
C-121. Applied research, by selected agency: FY 1973-83
C-122. Development, by selected agency: FY 1973-83
C-123. Research and development, by performer: FY 1973-83
C-124. Total research, by performer: FY 1973-83
C-125. Basic research, by performer: FY 1973-83
C-126. Applied research, by performer: FY 1973-83
C-127. Development by performer: FY 1973-83
C-128. Total research, by field of science: FY 1973-83
C-129. Basic research, by field of science: FY 1973-83
C-130. Applied research, by field of science: FY 1973-83
C-131. Research and development, by geographic division and State: FY 1970-81
C-132. R&D plant, by geographic division and State: FY 1970-81

notes

- Estimates for 1983 are based on *The Budget of the United States Government, Fiscal Year 1983*, as submitted to Congress by the administration, and do not reflect subsequent appropriations and apportionment actions.
- Details may not add to totals because of rounding.
- Asterisks appearing in lieu of figures indicate that the amounts are less than $50,000 or less than .05 percent.
- The abbreviation "FFRDC's" appearing in statistical tables refers to federally funded research and development centers.
- Within the Department of Agriculture the Economic Research Service and the Statistical Reporting Service replace the Economics and Statistics Service the headings Agricultural Research Service and Cooperative State Research Service replace the headings Agricultural Research and Agricultural Cooperative Research that were formerly included within the Science and Education Administration; the Human Nutrition Information Service is a new heading.
- In tables showing extramural performers, obligations of the Department of Agriculture to agricultural experiment stations are included within obligations to universities and colleges.
- The proposed Energy Research and Technology Administration replaces the Department of Energy and is shown within the Department of Commerce.
- Defense Agencies within the Department of Defense include the Defense Advanced Research Projects Agency, the Defense Nuclear Agency, the Defense Communications Agency, the Defense Mapping Agency, the Defense Logistics Agency, the Uniformed Services University of the Health Sciences, and technical support, Joint Chiefs of Staff/Office of the Secretary of Defense.
- The Bonneville Power Administration, formerly within the Department of Energy, is shown within the Department of the Interior.
- The Maritime Administration, formerly within the Department of Commerce, is now within the Department of Transportation.
- The proposed Foundation for Educational Assistance replaces the Department of Education.
- R&D data reported by the National Aeronautics and Space Administration are in terms of budget plan rather than obligations.
- The historical tables for Volume XXXI, providing data on R&D totals for 1973 through 1983 (C-112 through C-132), are not comparable with totals for those years in appendix tables issued to accompany earlier *Federal Funds* reports. Some prior-year changes occur almost almost every year, thus changing totals in many categories.

NOTE: **For trend comparisons, use only these tables, appendix C, for Volume XXXI. Do not use the earlier tables in the Federal Funds series.**

TABLE C-1. SUMMARY OF FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT: FISCAL YEARS 1981, 1982, AND 1983

(MILLIONS OF DOLLARS)

ITEM	ACTUAL, 1981	ESTIMATES			
		1982	% CHG 1981-1982	1983	% CHG 1982-1983
TOTAL OUTLAYS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT	35,785.9	39,316.8	9.9%	42,381.5	7.8%
RESEARCH AND DEVELOPMENT	34,179.2	37,621.6	10.1	41,173.6	9.4
R&D PLANT	1,606.7	1,695.3	5.5	1,207.9	-28.7
TOTAL OBLIGATIONS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT	36,403.1	40,438.0	11.1	44,272.4	9.5
RESEARCH AND DEVELOPMENT	34,917.4	38,954.1	11.6	42,973.8	10.3
PERFORMERS:					
FEDERAL INTRAMURAL 1/	8,728.8	9,645.1	10.5	10,164.3	5.4
INDUSTRIAL FIRMS	16,260.6	19,212.3	18.2	22,442.6	16.8
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	1,413.9	1,476.9	4.5	1,441.9	-2.4
UNIVERSITIES AND COLLEGES	4,478.0	4,583.5	2.4	4,720.0	3.0
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	1,828.5	1,889.8	3.3	1,962.8	3.9
OTHER NONPROFIT INSTITUTIONS	1,120.2	1,112.3	-.7	1,165.7	4.8
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	525.2	490.6	-6.6	558.2	13.8
STATE AND LOCAL GOVERNMENTS	222.2	201.7	-9.2	204.5	1.4
FOREIGN	340.0	342.0	.6	313.8	-8.2
RESEARCH	12,212.8	12,595.0	3.1	13,264.9	5.3
PERFORMERS:					
FEDERAL INTRAMURAL 1/	4,034.2	4,152.3	2.9	4,402.8	6.0
INDUSTRIAL FIRMS	1,958.3	1,974.8	.8	2,137.1	8.2
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	351.3	417.5	18.8	407.9	-2.3
UNIVERSITIES AND COLLEGES	3,920.2	3,996.9	2.0	4,130.1	3.3
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	940.6	1,019.2	8.4	1,107.5	8.7
OTHER NONPROFIT INSTITUTIONS	705.2	697.6	-1.1	721.5	3.4
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	67.7	87.5	29.2	93.5	6.8
STATE AND LOCAL GOVERNMENTS	129.3	123.5	-4.5	140.6	13.9
FOREIGN	106.0	125.8	18.7	123.8	-1.6
FIELDS OF SCIENCE:					
LIFE SCIENCES	4,435.6	4,593.0	3.5	4,735.0	3.1
PSYCHOLOGY	208.9	214.8	2.8	258.0	20.1
PHYSICAL SCIENCES	2,220.5	2,510.1	13.0	2,846.3	13.4
ENVIRONMENTAL SCIENCES	1,121.1	1,092.8	-2.5	1,097.7	.5
MATHEMATICS AND COMPUTER SCIENCES	278.9	310.6	11.3	356.5	14.8
ENGINEERING	3,071.5	3,136.9	2.1	3,172.3	1.1
SOCIAL SCIENCES	497.4	405.8	-18.4	397.8	-2.0
OTHER SCIENCES, NEC	378.8	331.1	-12.6	401.3	21.2
BASIC RESEARCH	5,041.3	5,310.9	5.3	5,765.2	8.6
PERFORMERS:					
FEDERAL INTRAMURAL 1/	1,301.8	1,396.2	7.2	1,541.6	10.4
INDUSTRIAL FIRMS	292.9	316.6	8.1	383.5	21.2
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	73.3	80.5	9.8	87.8	9.1
UNIVERSITIES AND COLLEGES	2,503.2	2,618.0	4.6	2,758.9	5.4
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	490.6	514.2	4.8	590.8	14.9
OTHER NONPROFIT INSTITUTIONS	313.1	315.8	.8	329.9	4.5
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	8.6	8.2	-5.3	9.4	14.8
STATE AND LOCAL GOVERNMENTS	26.5	28.4	6.9	32.3	14.0
FOREIGN	31.2	33.1	6.2	31.0	-6.2
FIELDS OF SCIENCE:					
LIFE SCIENCES	2,223.9	2,330.0	4.8	2,428.3	4.2
PSYCHOLOGY	91.0	92.3	1.4	100.0	8.4
PHYSICAL SCIENCES	1,324.9	1,432.0	8.1	1,650.4	15.2
ENVIRONMENTAL SCIENCES	532.8	523.7	-1.7	559.4	6.8
MATHEMATICS AND COMPUTER SCIENCES	140.4	164.9	17.5	185.5	12.5
ENGINEERING	526.0	587.9	11.8	655.4	11.5
SOCIAL SCIENCES	137.0	121.5	-11.3	124.3	2.3
OTHER SCIENCES, NEC	65.4	58.6	-10.4	62.0	5.8
APPLIED RESEARCH	7,171.5	7,284.1	1.6	7,499.7	3.0
PERFORMERS:					
FEDERAL INTRAMURAL 1/	2,732.4	2,756.2	.9	2,861.2	3.8
INDUSTRIAL FIRMS	1,665.4	1,658.2	-.4	1,753.6	5.8
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	278.1	337.0	21.2	320.1	-5.0
UNIVERSITIES AND COLLEGES	1,416.9	1,378.9	-2.7	1,371.3	-.6
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	450.0	504.9	12.2	516.8	2.3
OTHER NONPROFIT INSTITUTIONS	392.1	381.9	-2.6	391.6	2.5
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	59.1	79.3	34.3	84.1	6.0
STATE AND LOCAL GOVERNMENTS	102.8	95.1	-7.5	108.3	13.9
FOREIGN	74.8	92.7	23.9	92.8	.1
FIELDS OF SCIENCE:					
LIFE SCIENCES	2,211.8	2,263.1	2.3	2,306.7	1.9
PSYCHOLOGY	117.9	122.5	3.9	158.0	29.0
PHYSICAL SCIENCES	895.6	1,078.0	20.4	1,195.9	10.9
ENVIRONMENTAL SCIENCES	588.3	569.1	-3.3	538.3	-5.4
MATHEMATICS AND COMPUTER SCIENCES	138.6	145.6	5.1	171.0	17.4
ENGINEERING	2,545.5	2,549.0	.1	2,517.0	-1.3
SOCIAL SCIENCES	360.5	284.3	-21.1	273.5	-3.8
OTHER SCIENCES, NEC	313.5	272.5	-13.1	339.3	24.5

CONTINUED ON NEXT PAGE

TABLE C-1. SUMMARY OF FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT: FISCAL YEARS 1981, 1982, AND 1983

(MILLIONS OF DOLLARS)

- CONTINUED

ITEM	ACTUAL, 1981	ESTIMATES 1982	% CHG 1981-1982	1983	% CHG 1982-1983
DEVELOPMENT	22,704.6	26,359.1	16.1%	29,708.9	12.7%
PERFORMERS:					
FEDERAL INTRAMURAL 1/	4,694.6	5,492.8	17.0	5,761.5	4.9
INDUSTRIAL FIRMS	14,302.3	17,237.5	20.5	20,305.5	17.8
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	1,062.6	1,059.4	-.3	1,034.0	-2.4
UNIVERSITIES AND COLLEGES	557.8	586.6	5.2	589.9	.6
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	887.9	870.6	-2.0	855.2	-1.8
OTHER NONPROFIT INSTITUTIONS	415.0	414.7	-.1	444.2	7.1
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	457.5	403.1	-11.9	464.7	15.3
STATE AND LOCAL GOVERNMENTS	92.9	78.3	-15.7	63.9	-18.4
FOREIGN	234.0	216.2	-7.6	190.0	-12.1
R&D PLANT	1,485.7	1,483.9	-.1	1,298.6	-12.5
PERFORMERS SUPPORTED:					
FEDERAL INTRAMURAL	468.0	460.3	-1.6	559.2	21.5
INDUSTRIAL FIRMS	302.1	188.8	-37.5	73.1	-61.3
FFRDCS ADMINISTERED BY INDUSTRIAL FIRMS	246.5	294.7	19.5	189.5	-35.7
UNIVERSITIES AND COLLEGES	37.0	32.9	-11.1	45.9	39.3
FFRDCS ADMINISTERED BY UNIVERSITIES AND COLLEGES	370.9	433.2	16.8	274.5	-36.6
OTHER NONPROFIT INSTITUTIONS	41.3	61.6	49.1	146.2	137.4
FFRDCS ADMINISTERED BY NONPROFIT INSTITUTIONS	15.1	8.1	-46.3	5.3	-34.3
FOREIGN	4.8	4.2	-12.1	4.9	14.9

1/ COSTS ASSOCIATED WITH THE ADMINISTRATION OF INTRAMURAL AND EXTRAMURAL PROGRAMS ARE COVERED AS WELL AS ACTUAL INTRAMURAL PERFORMANCE.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE C-2. FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT, BY AGENCY: FISCAL YEARS 1981, 1982, AND 1983

(MILLIONS OF DOLLARS)

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1981	ESTIMATES		1981	ESTIMATES	
		1982	1983		1982	1983
TOTAL, ALL AGENCIES	36,403.1	40,438.0	44,272.4	35,785.9	39,316.8	42,381.5
DEPARTMENTS						
DEPARTMENT OF AGRICULTURE, TOTAL	794.7	842.0	869.2	782.5	845.8	859.8
AGRICULTURAL COOPERATIVE SERVICE	1.7	1.8	1.4	1.3	1.8	1.4
AGRICULTURAL MARKETING SERVICE	1.1	1.5	-	1.2	1.5	-
AGRICULTURAL RESEARCH SERVICE	411.6	446.2	475.4	425.9	441.9	467.0
COOPERATIVE STATE RESEARCH SERVICE	199.4	221.2	232.1	199.0	226.6	228.6
ECONOMIC RESEARCH SERVICE	39.3	39.4	40.6	38.0	39.1	40.3
FOREST SERVICE	129.3	110.8	98.4	101.8	114.9	100.2
HUMAN NUTRITION INFORMATION SERVICE	-	9.2	8.3	-	5.9	7.6
OFFICE OF INTERNATIONAL COOPERATION AND DEVELOPMENT	3.9	4.0	3.9	6.9	6.2	5.8
OFFICE OF TRANSPORTATION	.9	1.0	.9	.9	1.0	.9
STATISTICAL REPORTING SERVICE	7.5	7.0	8.0	7.5	7.0	8.0
DEPARTMENT OF COMMERCE, TOTAL	6,225.7	5,848.4	4,871.9	6,472.7	6,526.8	4,997.0
BUREAU OF THE CENSUS	3.9	3.8	4.1	3.8	3.6	4.1
ECONOMIC DEVELOPMENT ADMINISTRATION	28.1	8.4	-	35.5	9.4	3.4
ENERGY RESEARCH AND TECHNOLOGY ADMINISTRATION 1/	5,896.4	5,558.6	4,634.0	6,125.9	6,221.6	4,740.1
NATIONAL BUREAU OF STANDARDS	83.0	99.3	83.5	84.4	93.5	85.8
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION	202.2	166.3	140.8	209.0	183.5	150.8
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMIN	10.9	11.3	8.9	12.9	14.2	12.2
OFFICE OF THE SECRETARY	-	.1	-	.1	.2	-
PATENT AND TRADEMARK OFFICE	1.1	.6	.7	1.1	.6	.7
DEPARTMENT OF DEFENSE, TOTAL	16,786.3	20,887.5	24,885.5	15,993.0	19,079.0	23,042.5
DEPARTMENT OF THE ARMY	3,257.0	3,730.0	4,627.2	3,123.7	3,550.3	4,233.8
MILITARY FUNCTIONS	3,226.7	3,701.0	4,596.8	3,093.7	3,521.3	4,203.4
MILITARY CONSTRUCTION	9.6	22.9	28.4	5.8	9.2	19.3
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	131.1	146.9	145.6	129.9	146.0	145.2
RDT&E APPROPRIATION	3,086.0	3,531.2	4,422.8	2,958.0	3,366.1	4,038.9
CIVIL FUNCTIONS (CORPS OF ENGINEERS)	30.3	29.0	30.4	30.0	29.0	30.4
DEPARTMENT OF THE NAVY	5,103.9	5,930.7	6,378.6	4,916.9	5,570.9	6,107.5
MILITARY CONSTRUCTION	18.0	25.6	26.0	12.2	17.0	17.2
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	120.2	141.4	142.4	119.3	141.1	142.2
RDT&E APPROPRIATION	4,965.5	5,759.6	6,206.8	4,782.9	5,411.6	5,947.1
SPECIAL FOREIGN CURRENCY PROGRAM	.2	4.1	3.4	2.5	1.2	1.0
DEPARTMENT OF THE AIR FORCE	7,128.8	9,494.1	11,604.0	6,756.6	8,405.8	10,684.0
MILITARY CONSTRUCTION	108.6	50.3	124.0	87.0	49.6	96.0
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	333.7	392.7	397.1	328.7	386.9	391.0
RDT&E APPROPRIATION	6,686.5	9,051.1	11,082.9	6,340.9	7,969.3	10,197.0
DEFENSE AGENCIES	1,255.6	1,681.8	2,217.3	1,160.0	1,508.6	1,965.0
MILITARY CONSTRUCTION	-	.5	.2	-	-	-
RDT&E APPROPRIATION	1,255.6	1,681.3	2,217.1	1,160.0	1,508.1	1,964.8
DIRECTOR OF TEST & EVALUATION, DEFENSE	41.1	50.9	58.4	35.7	43.4	52.2
DEPARTMENT OF HEALTH AND HUMAN SERVICES, TOTAL	3,950.9	4,002.8	4,172.4	3,997.5	3,992.1	4,087.7
ALCOHOL, DRUG ABUSE & MENTAL HEALTH ADMINISTRATION	239.7	259.0	288.8	251.1	263.1	280.6
CENTERS FOR DISEASE CONTROL	74.8	70.5	72.0	83.0	75.1	73.6
FOOD & DRUG ADMINISTRATION	72.6	74.7	109.7	57.6	59.2	63.3
HEALTH CARE FINANCING ADMINISTRATION	38.6	29.5	30.0	35.4	29.5	30.0
HEALTH RESOURCES ADMINISTRATION	5.0	2.5	-	3.7	4.3	3.4
HEALTH SERVICES ADMINISTRATION	20.3	4.0	1.9	16.9	6.9	4.3
HUMAN DEVELOPMENT SERVICES	73.7	61.3	64.5	85.5	70.6	59.8
NATIONAL INSTITUTES OF HEALTH	3,355.5	3,454.8	3,554.1	3,392.2	3,423.9	3,516.3
OFFICE OF ASSISTANT SECRETARY FOR HEALTH	33.1	16.6	16.9	37.2	30.0	23.3
OFFICE OF THE SECRETARY	19.5	13.4	14.7	19.5	13.4	14.7
SOCIAL SECURITY ADMINISTRATION	18.0	16.5	19.8	15.4	15.9	18.3
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	48.1	34.5	31.1	54.1	39.2	36.5
DEPARTMENT OF THE INTERIOR, TOTAL	430.6	405.1	366.4	436.9	412.1	374.4
BONNEVILLE POWER ADMINISTRATION	14.4	19.1	22.1	14.0	19.9	22.0
BUREAU OF LAND MANAGEMENT	1.9	2.0	2.7	1.9	2.7	2.7
BUREAU OF MINES	97.4	94.9	77.9	109.0	98.0	83.9
BUREAU OF RECLAMATION	14.3	10.4	10.1	13.4	13.8	10.1
GEOLOGICAL SURVEY	169.8	157.8	149.5	168.2	158.7	149.1
NATIONAL PARK SERVICE	10.4	11.1	10.8	10.4	11.1	10.8
OFFICE OF THE SECRETARY	1.5	.6	.6	2.0	.5	.6
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT	5.8	1.0	1.5	5.8	1.0	1.5
OFFICE OF WATER RESEARCH & TECHNOLOGY	21.8	13.4	-	21.8	13.4	-
UNITED STATES FISH AND WILDLIFE SERVICE	93.3	94.8	91.3	90.5	93.1	93.7

CONTINUED ON NEXT PAGE

TABLE C-2. FEDERAL FUNDS FOR RESEARCH, DEVELOPMENT, AND R&D PLANT, BY AGENCY: FISCAL YEARS 1981, 1982, AND 1983

(MILLIONS OF DOLLARS)

- CONTINUED

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1981	ESTIMATES		1981	ESTIMATES	
		1982	1983		1982	1983
DEPARTMENT OF JUSTICE, TOTAL	26.5	30.0	22.0	26.1	30.2	29.3
DRUG ENFORCEMENT ADMINISTRATION	1.3	3.4	1.9	1.2	2.0	2.1
FEDERAL BUREAU OF INVESTIGATION	.7	2.1	1.1	1.5	2.0	2.3
FEDERAL PRISON SYSTEM	2.5	2.6	2.6	2.5	2.6	2.6
IMMIGRATION AND NATURALIZATION SERVICE	.1	1.3	.4	1.0	1.3	.4
OFFICE OF THE ATTORNEY GENERAL	.8	.9	.8	.7	.8	.7
OFFICE OF JUSTICE ASSISTANCE, RESEARCH, AND STATISTICS	21.0	19.7	15.2	19.2	21.5	21.2
DEPARTMENT OF LABOR, TOTAL	62.2	30.8	9.9	61.6	36.1	9.7
BUREAU OF LABOR STATISTICS	0.3	0.3	0.3	0.3	0.3	0.3
EMPLOYMENT STANDARDS ADMINISTRATION	3.2	2.0	1.9	3.0	1.8	1.8
EMPLOYMENT AND TRAINING ADMINISTRATION	52.4	21.3	-	52.1	26.9	-
LABOR-MANAGEMENT SERVICES ADMINISTRATION	1.8	.6	.6	1.7	.6	.6
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION	3.0	4.9	5.7	3.0	4.9	5.7
OFFICE OF THE SECRETARY	1.1	.9	.9	1.0	.8	.8
PENSION BENEFIT GUARANTEE CORPORATION	.5	.8	.5	.5	.8	.5
DEPARTMENT OF STATE, TOTAL	1.8	2.0	1.8	1.8	2.0	1.8
DEPARTMENTAL FUNDS	1.8	2.0	1.8	1.8	2.0	1.8
DEPARTMENT OF TRANSPORTATION, TOTAL	434.5	342.1	375.9	432.1	346.2	329.7
COAST GUARD	26.3	18.0	15.0	25.9	18.0	15.0
FEDERAL AVIATION ADMINISTRATION	128.9	102.7	160.3	125.9	103.3	129.7
FEDERAL HIGHWAY ADMINISTRATION	51.2	49.9	51.8	59.1	53.2	50.7
FEDERAL RAILROAD ADMINISTRATION	46.1	43.3	20.0	55.0	30.0	19.5
MARITIME ADMINISTRATION	14.2	9.3	16.8	17.4	14.2	15.4
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	66.4	55.3	59.7	60.8	64.2	57.2
OFFICE OF THE SECRETARY	10.1	4.0	7.8	13.9	6.6	5.1
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION	13.1	11.2	10.5	12.3	7.8	7.8
URBAN MASS TRANSPORTATION ADMINISTRATION	78.2	48.4	34.0	61.9	48.9	29.3
DEPARTMENT OF THE TREASURY, TOTAL	11.4	12.1	13.2	10.8	12.5	13.4
BUREAU OF ALCOHOL, TOBACCO, AND FIREARMS	.3	-	-	.3	-	-
BUREAU OF ENGRAVING AND PRINTING	2.7	4.0	2.2	2.7	4.0	2.2
INTERNAL REVENUE SERVICE	4.2	5.1	7.9	4.2	5.1	7.9
OFFICE OF PROTECTIVE RESEARCH	.6	*	-	.1	.4	.2
UNITED STATES CUSTOMS SERVICE	3.5	3.0	3.1	3.5	3.0	3.1
OTHER AGENCIES						
ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS	2.2	1.9	1.9	1.9	1.9	1.9
APPALACHIAN REGIONAL COMMISSION	.4	.4	-	.4	.4	-
COMMUNITY SERVICES ADMINISTRATION	18.3	-	-	26.2	6.2	-
CONSUMER PRODUCT SAFETY COMMISSION	.5	.2	.6	.9	.3	.4
ENVIRONMENTAL PROTECTION AGENCY	325.7	317.1	229.9	344.3	334.7	273.9
FEDERAL COMMUNICATIONS COMMISSION	1.8	1.0	.7	1.6	.9	.6
FEDERAL EMERGENCY MANAGEMENT AGENCY	11.6	9.3	18.1	11.6	9.3	18.1
FEDERAL HOME LOAN BANK BOARD	1.0	1.2	1.5	1.0	1.2	1.5
FEDERAL TRADE COMMISSION	1.1	1.2	1.3	1.1	1.2	1.3
FOUNDATION FOR EDUCATION ASSISTANCE 2/	104.9	84.9	87.0	111.8	105.6	104.1
GENERAL SERVICES ADMINISTRATION	.6	.8	1.5	.6	.8	1.5
INTERNATIONAL COMMUNICATION AGENCY	1.5	1.5	.2	1.2	1.7	1.1
INTERNATIONAL DEVELOPMENT COOPERATION AGENCY	142.2	163.8	139.9	166.1	168.7	195.3
AGENCY FOR INTERNATIONAL DEVELOPMENT	142.2	163.8	139.9	166.1	168.7	195.3
INTERNATIONAL TRADE COMMISSION	3.4	3.6	4.0	3.4	3.6	4.0
LIBRARY OF CONGRESS	4.9	5.3	5.3	5.1	5.6	5.2
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	5,522.4	5,940.0	6,612.9	5,425.6	5,831.0	6,582.0
NATIONAL SCIENCE FOUNDATION	976.2	970.5	1,049.2	905.0	1,027.8	923.0
NUCLEAR REGULATORY COMMISSION	227.3	222.7	219.7	216.0	213.8	206.5
OFFICE OF PERSONNEL MANAGEMENT	8.4	5.8	5.1	8.1	5.6	4.9
SMITHSONIAN INSTITUTION	45.3	48.9	51.8	43.9	48.1	51.7
TENNESSEE VALLEY AUTHORITY	69.3	82.5	74.7	94.3	87.9	74.7
UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY	2.4	.7	1.2	2.4	.7	1.2
VETERANS ADMINISTRATION	159.2	137.4	146.8	144.3	137.8	147.0

1/ THE 1983 BUDGET PROPOSED THAT THE DEPARTMENT OF ENERGY BE REPLACED BY THE ENERGY RESEARCH AND TECHNOLOGY ADMINISTRATION WITHIN THE DEPARTMENT OF COMMERCE.

2/ THE 1983 BUDGET PROPOSED THAT THE DEPARTMENT OF EDUCATION BE REPLACED BY THE FOUNDATION FOR EDUCATION ASSISTANCE.

* INDICATES AMOUNT LESS THAN $50,000.

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE C-3. FEDERAL FUNDS FOR TOTAL RESEARCH AND DEVELOPMENT, BY AGENCY: FISCAL YEARS 1981, 1982, AND 1983

(MILLIONS OF DOLLARS)

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1981	ESTIMATES		1981	ESTIMATES	
		1982	1983		1982	1983
TOTAL, ALL AGENCIES	34,917.4	38,954.1	42,973.8	34,179.2	37,621.6	41,173.5
DEPARTMENTS						
DEPARTMENT OF AGRICULTURE, TOTAL	774.0	807.4	838.9	743.4	806.5	825.9
AGRICULTURAL COOPERATIVE SERVICE	1.7	1.8	1.4	1.3	1.8	1.4
AGRICULTURAL MARKETING SERVICE	1.1	1.5	-	1.2	1.5	-
AGRICULTURAL RESEARCH SERVICE	394.1	412.0	454.5	390.1	405.3	435.8
COOPERATIVE STATE RESEARCH SERVICE	199.4	221.2	223.3	199.0	226.6	226.8
ECONOMIC RESEARCH SERVICE	39.3	39.4	40.6	38.0	39.1	40.3
FOREST SERVICE	126.1	110.4	98.0	98.6	112.2	99.2
HUMAN NUTRITION INFORMATION SERVICE	-	9.2	8.3	-	5.9	7.6
OFFICE OF INTERNATIONAL COOPERATION AND DEVELOPMENT	3.9	4.0	3.9	6.9	6.2	5.8
OFFICE OF TRANSPORTATION	.9	1.0	.9	.9	1.0	.9
STATISTICAL REPORTING SERVICE	7.5	7.0	8.0	7.5	7.0	8.0
DEPARTMENT OF COMMERCE, TOTAL	5,246.2	4,864.4	4,178.9	5,386.9	5,344.3	4,350.9
BUREAU OF THE CENSUS	3.9	3.8	4.1	3.8	3.6	4.1
ECONOMIC DEVELOPMENT ADMINISTRATION	28.1	8.4	-	35.5	9.4	3.4
ENERGY RESEARCH AND TECHNOLOGY ADMINISTRATION 1/	4,918.2	4,583.5	3,944.2	5,041.4	5,046.5	4,097.0
NATIONAL BUREAU OF STANDARDS	82.5	90.3	80.3	83.9	86.1	82.8
NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION	201.4	166.3	140.8	208.1	183.5	150.8
NATIONAL TELECOMMUNICATIONS & INFORMATION ADMIN	10.9	11.3	8.9	12.9	14.2	12.2
OFFICE OF THE SECRETARY	-	.1	-	.1	.2	-
PATENT AND TRADEMARK OFFICE	1.1	.6	.7	1.1	.6	.7
DEPARTMENT OF DEFENSE, TOTAL	16,508.6	20,602.3	24,519.6	15,754.5	18,830.8	22,722.3
DEPARTMENT OF THE ARMY	3,244.2	3,702.2	4,594.3	3,114.8	3,537.0	4,210.0
MILITARY FUNCTIONS	3,213.9	3,673.2	4,563.9	3,084.8	3,508.0	4,179.6
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	131.1	146.9	145.6	129.9	146.0	145.2
RDT&E APPROPRIATION	3,082.8	3,526.3	4,418.3	2,954.9	3,362.0	4,034.4
CIVIL FUNCTIONS (CORPS OF ENGINEERS)	30.3	29.0	30.4	30.0	29.0	30.4
DEPARTMENT OF THE NAVY	5,006.0	5,820.2	6,251.4	4,824.7	5,475.2	5,991.9
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	120.2	141.4	142.4	119.3	141.1	142.2
RDT&E APPROPRIATION	4,885.6	5,674.7	6,105.6	4,702.9	5,332.9	5,848.7
SPECIAL FOREIGN CURRENCY PROGRAM	.2	4.1	3.4	2.5	1.2	1.0
DEPARTMENT OF THE AIR FORCE	6,969.2	9,355.8	11,405.0	6,626.6	8,275.2	10,510.0
PAY & ALLOWANCES OF MILITARY PERSONNEL IN R&D	333.7	392.7	397.1	328.7	386.9	391.0
RDT&E APPROPRIATION	6,635.5	8,963.1	11,007.9	6,297.9	7,888.3	10,119.0
DEFENSE AGENCIES	1,248.2	1,673.2	2,210.5	1,152.6	1,500.0	1,958.2
RDT&E APPROPRIATION	1,248.2	1,673.2	2,210.5	1,152.6	1,500.0	1,958.2
DIRECTOR OF TEST & EVALUATION, DEFENSE	41.1	50.9	58.4	35.7	43.4	52.2
DEPARTMENT OF HEALTH AND HUMAN SERVICES, TOTAL	3,927.1	3,967.9	4,117.8	3,954.9	3,958.2	4,052.7
ALCOHOL, DRUG ABUSE & MENTAL HEALTH ADMINISTRATION	239.4	252.2	288.7	250.9	262.0	276.8
CENTERS FOR DISEASE CONTROL	74.8	70.5	72.0	83.0	75.1	73.6
FOOD & DRUG ADMINISTRATION	71.4	72.7	74.7	57.1	58.2	59.8
HEALTH CARE FINANCING ADMINISTRATION	38.6	29.5	30.0	35.4	29.5	30.0
HEALTH RESOURCES ADMINISTRATION	5.0	2.5	-	3.7	4.3	3.4
HEALTH SERVICES ADMINISTRATION	20.3	4.0	1.9	16.9	6.9	4.3
HUMAN DEVELOPMENT SERVICES	73.7	61.3	64.5	85.5	70.6	59.8
NATIONAL INSTITUTES OF HEALTH	3,333.2	3,428.7	3,534.6	3,350.2	3,392.1	3,488.6
OFFICE OF ASSISTANT SECRETARY FOR HEALTH	33.1	16.6	16.9	37.2	30.0	23.3
OFFICE OF THE SECRETARY	19.5	13.4	14.7	19.5	13.4	14.7
SOCIAL SECURITY ADMINISTRATION	18.0	16.5	19.8	15.4	15.9	18.3
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT	48.1	34.5	31.1	54.1	39.2	36.5
DEPARTMENT OF THE INTERIOR, TOTAL	427.1	403.4	364.7	432.8	410.1	372.8
BONNEVILLE POWER ADMINISTRATION	14.2	18.7	21.7	13.7	19.5	21.7
BUREAU OF LAND MANAGEMENT	1.9	2.0	2.7	1.9	2.7	2.7
BUREAU OF MINES	96.7	94.6	77.9	106.9	97.7	83.6
BUREAU OF RECLAMATION	14.3	10.4	10.1	13.4	13.8	10.1
GEOLOGICAL SURVEY	169.8	157.8	149.5	168.2	158.7	149.1
NATIONAL PARK SERVICE	10.4	11.1	10.8	10.4	11.1	10.8
OFFICE OF THE SECRETARY	1.5	.6	.6	2.0	.5	.6
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT	5.8	1.0	1.5	5.8	1.0	1.5
OFFICE OF WATER RESEARCH & TECHNOLOGY	21.1	12.8	-	21.1	12.8	-
UNITED STATES FISH AND WILDLIFE SERVICE	91.5	94.3	89.9	89.5	92.3	92.7

CONTINUED ON NEXT PAGE

TABLE C-3. FEDERAL FUNDS FOR TOTAL RESEARCH AND DEVELOPMENT, BY AGENCY: FISCAL YEARS 1981, 1982, AND 1983

(MILLIONS OF DOLLARS)

- CONTINUED

AGENCY AND SUBDIVISION	OBLIGATIONS			OUTLAYS		
	1981	ESTIMATES		1981	ESTIMATES	
		1982	1983		1982	1983
DEPARTMENT OF JUSTICE, TOTAL	26.5	30.0	22.0	26.1	30.2	29.3
DRUG ENFORCEMENT ADMINISTRATION	1.3	3.4	1.9	1.2	2.0	2.1
FEDERAL BUREAU OF INVESTIGATION	.7	2.1	1.1	1.5	2.0	2.3
FEDERAL PRISON SYSTEM	2.5	2.6	2.6	2.5	2.6	2.6
IMMIGRATION AND NATURALIZATION SERVICE	.1	1.3	.4	1.0	1.3	.4
OFFICE OF THE ATTORNEY GENERAL	.8	.9	.8	.7	.8	.7
OFFICE OF JUSTICE ASSISTANCE, RESEARCH, AND STATISTICS	21.0	19.7	15.2	19.2	21.5	21.2
DEPARTMENT OF LABOR, TOTAL	62.2	30.8	9.9	61.6	36.1	9.7
BUREAU OF LABOR STATISTICS	0.3	0.3	0.3	0.3	0.3	0.3
EMPLOYMENT STANDARDS ADMINISTRATION	3.2	2.0	1.9	3.0	1.8	1.8
EMPLOYMENT AND TRAINING ADMINISTRATION	52.4	21.3	-	52.1	26.9	-
LABOR-MANAGEMENT SERVICES ADMINISTRATION	1.8	.6	.6	1.7	.6	.6
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION	3.0	4.9	5.7	3.0	4.9	5.7
OFFICE OF THE SECRETARY	1.1	.9	.9	1.0	.8	.8
PENSION BENEFIT GUARANTEE CORPORATION	.5	.8	.5	.5	.8	.5
DEPARTMENT OF STATE, TOTAL	1.8	2.0	1.8	1.8	2.0	1.8
DEPARTMENTAL FUNDS	1.8	2.0	1.8	1.8	2.0	1.8
DEPARTMENT OF TRANSPORTATION, TOTAL	415.5	327.8	366.5	415.9	326.4	321.6
COAST GUARD	26.3	18.0	15.0	25.9	18.0	15.0
FEDERAL AVIATION ADMINISTRATION	120.0	96.7	151.5	119.8	99.0	123.5
FEDERAL HIGHWAY ADMINISTRATION	51.2	49.9	51.8	56.3	48.9	50.7
FEDERAL RAILROAD ADMINISTRATION	36.6	35.6	20.0	48.2	19.4	18.2
MARITIME ADMINISTRATION	14.2	9.3	16.8	17.4	14.2	15.4
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	65.9	54.7	59.1	60.3	63.6	56.6
OFFICE OF THE SECRETARY	10.1	4.0	7.8	13.9	6.6	5.1
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION	13.1	11.2	10.5	12.3	7.8	7.8
URBAN MASS TRANSPORTATION ADMINISTRATION	78.2	48.4	34.0	61.9	48.9	29.3
DEPARTMENT OF THE TREASURY, TOTAL	11.3	12.1	13.2	10.8	12.4	13.3
BUREAU OF ALCOHOL, TOBACCO, AND FIREARMS	.3	-	-	.3	-	-
BUREAU OF ENGRAVING AND PRINTING	2.7	4.0	2.2	2.7	4.0	2.2
INTERNAL REVENUE SERVICE	4.2	5.1	7.9	4.2	5.1	7.9
OFFICE OF PROTECTIVE RESEARCH	.6	*	-	.1	.4	.2
UNITED STATES CUSTOMS SERVICE	3.5	2.9	3.0	3.5	2.9	3.0
OTHER AGENCIES						
ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS	2.2	1.9	1.9	1.9	1.9	1.9
APPALACHIAN REGIONAL COMMISSION	.4	.4	-	.4	.4	-
COMMUNITY SERVICES ADMINISTRATION	18.3	-	-	26.2	6.2	-
CONSUMER PRODUCT SAFETY COMMISSION	.5	.2	.6	.9	.3	.4
ENVIRONMENTAL PROTECTION AGENCY	325.7	317.1	229.9	344.3	334.7	273.9
FEDERAL COMMUNICATIONS COMMISSION	1.8	1.0	.7	1.6	.9	.6
FEDERAL EMERGENCY MANAGEMENT AGENCY	11.6	9.3	18.1	11.6	9.3	18.1
FEDERAL HOME LOAN BANK BOARD	1.0	1.2	1.5	1.0	1.2	1.5
FEDERAL TRADE COMMISSION	1.1	1.2	1.3	1.1	1.2	1.3
FOUNDATION FOR EDUCATION ASSISTANCE 2/	104.9	84.9	87.0	111.8	105.6	104.1
GENERAL SERVICES ADMINISTRATION	.6	.8	1.5	.6	.8	1.5
INTERNATIONAL COMMUNICATION AGENCY	1.5	1.5	.2	1.2	1.7	1.1
INTERNATIONAL DEVELOPMENT COOPERATION AGENCY	134.2	155.9	132.0	159.9	159.5	183.3
AGENCY FOR INTERNATIONAL DEVELOPMENT	134.2	155.9	132.0	159.9	159.5	183.3
INTERNATIONAL TRADE COMMISSION	3.4	3.6	4.0	3.4	3.6	4.0
LIBRARY OF CONGRESS	4.9	5.3	5.3	5.1	5.6	5.2
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION	5,406.6	5,841.3	6,512.9	5,278.7	5,696.1	6,460.2
NATIONAL SCIENCE FOUNDATION	961.6	959.6	1,025.1	892.3	1,018.3	907.8
NUCLEAR REGULATORY COMMISSION	219.7	215.8	213.5	208.7	207.1	200.7
OFFICE OF PERSONNEL MANAGEMENT	8.4	5.8	5.1	8.1	5.6	4.9
SMITHSONIAN INSTITUTION	44.9	47.6	51.0	43.5	47.1	51.0
TENNESSEE VALLEY AUTHORITY	68.9	81.7	74.2	93.9	87.1	74.2
UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY	2.4	.7	1.2	2.4	.7	1.2
VETERANS ADMINISTRATION	144.4	135.0	142.6	137.8	130.5	140.1

1/ THE 1983 BUDGET PROPOSED THAT THE DEPARTMENT OF ENERGY BE REPLACED BY THE ENERGY RESEARCH AND TECHNOLOGY ADMINISTRATION WITHIN THE DEPARTMENT OF COMMERCE.

2/ THE 1983 BUDGET PROPOSED THAT THE DEPARTMENT OF EDUCATION BE REPLACED BY THE FOUNDATION FOR EDUCATION ASSISTANCE.

* INDICATES AMOUNT LESS THAN $50,000.

SOURCE: NATIONAL SCIENCE FOUNDATION

other science resources publications

Science Resources Studies Highlights

S/E Personnel

	NSF No.	Price
"Academic Employment of Scientists and Engineers Continued to Grow in 1982, But Slower than in Other Economic Sectors"	83-317	-----
"Growth in Neuroscience May be Leveling Off"	83-314	-----
"Graduate Science/Engineering Enrollment Rose 2% in 1981, Mostly in 'High-Tech' Fields"	83-310	-----
"Projected Employment Scenarios Show Possible Shortages in Some Engineering and Computer Specialties"	83-307	-----
"Manufacturing Employment Becoming Increasingly More Technological"	83-303	-----
"Growth in Science and Engineering Employment Accelerated in 1980 to 1981—But Demand May Have Slackened in 1982"	83-300	-----
"Labor Market Slackens for New Science and Engineering Graduates"	82-330	-----
"Growth in Employment of Science and Engineering Doctorates Continues, Led by Computer Scientists"	82-328	-----
"Science/Engineering Doctorate Production Increases in 1981; More New Doctorates Seek Nonacademic Positions"	82-323	-----
"Employment of Recent Science and Engineering (S/E) Graduates in S/E Fields Increased"	82-320	-----
"Labor Markets for New Science and Engineering Graduates in Private Industry"	82-310	-----
"Growth in Scientific and Engineering Employment Slows Between 1978-80"	82-303	-----

Detailed Statistical Tables

S/E Personnel

	NSF No.	Price
Academic Science/Engineering: Scientists and Engineers, January 1982	83-311	-----
Academic Science/Engineering: Graduate Enrollment and Support, Fall 1981	83-305	-----
Characteristics of Doctoral Scientists and Engineers in the United States: 1981	82-332	-----
U.S. Scientists and Engineers: 1980	82-314	-----
Characteristics of Recent Science/Engineering Graduates: 1980	82-313	-----

Reports

R&D Funds

	NSF No.	Price
Trends to 1982 in Industrial Basic Research	83-302	$3.50
1990 R&D Funding Projections	82-315	$3.50

S/E Personnel

	NSF No.	Price
Science and Engineering Doctorates: 1960-81	83-309	-----
Changing Employment Patterns of Scientists, Engineers, and Technicians in Manufacturing Industries: 1977-80	82-331	-----
Science and Engineering Degrees: 1950-80. A Source Book	82-307	$5.00
Women and Minorities in Science and Engineering	82-302	$7.00
Activities of Science and Engineering Faculty in Universities and 4-Year Colleges: 1978/79	81-323	-----
Young and Senior Science and Engineering Faculty, 1980	81-319	-----
Foreign Participation in U.S. Science and Engineering Higher Education and Labor Markets	81-316	$4.50
Science and Engineering Employment: 1970-80	81-310	$2.75

Composite

	NSF No.	Price
Science and Engineering Personnel: A National Overview	82-318	$5.00